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CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—

Annual Meeting New England Association of Gas Engineers..... 85
First Annual Meeting of the Ohio Gas Light Association..... 85

EDITORIALS—

The Gas Reformers of New York City..... 85
There Will be no Conflict in Future..... 86
The Latest from Boston..... 86
A Misprint..... 86
Map Showing Location and Surrouudings of the Youghiogheny River Coal Company's Ocean Mine Gas Coal..... 87
On the Use of Coal Gas—Lecture No. III., Coal Gas as a Source of Heat—By H. Dixon..... 88
Annual Report of the Edison Electric Illuminating Company..... 91
Sir F. Bramwell on the Progress of Invention..... 92
Hocking Valley (Ohio) Coal..... 94
Improvement in Electric Safety Lamps..... 95
Slag Cement..... 95
Dividends Paid by San Francisco Gas and Electric Light Companies in 1884..... 95

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 96

The Electric Lighting of Hell Gate Channel—Personal—Suffocated by Gas—For Sale at Half Price—Great Decrease in the English Coal Mining Death Rate—Boring for Natural Gas at Ironton, Ohio—Its True Function—One Way for Small Gas Companies to Avoid Trouble—Cheaper Gas for New Rochelle, N. Y.—Broken Panes—A Puzzled Saloonkeeper—Proposing to Make another Reduction—Some Thought it was Dynamite—Meter-Making Hands on Strike—Their Pledges were Kept—A Novel Point on which an Application for an Injunction is Based—Brooklyn (N. Y.) Street Lighting.

Recent Patents..... 98
The Market for Gas Securities..... 99

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

[OFFICIAL NOTICE.]

ANNUAL MEETING NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

OFFICE OF SECRETARY
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
BOSTON, MASS., Jan. 24, 1885.

The Annual Meeting of the Association will be held at Young's Hotel, Boston, on the 18th and 19th days of February, commencing at 11 o'clock A.M., on Wednesday, the 18th.

Members intending to propose the names of applicants for membership are requested to send them to the Secretary before the time of meeting.

The Board of Directors will meet in room 13, in Young's Hotel, on the evening of February 17th, at 8 o'clock. Papers to be read before the Association should be forwarded to the Secretary in time to be presented to the Directors at this meeting for their approval.

Friends of the Association are cordially invited to attend the Annual Meeting. Those wishing rooms engaged will please notify the Secretary on or before date of February 16th.

GEO. B. NEAL,
Secretary.

[OFFICIAL NOTICE.]

FIRST ANNUAL MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

SECRETARY'S OFFICE OHIO GAS LIGHT ASSOCIATION,
TIFFIN, OHIO, Jan. 19, 1885.

The First Annual Meeting of the Ohio Gas Light Association will be held at the Burnett House, Cincinnati, Ohio, on the 18th day of February, 1885.

The Executive Committee expects that all the members will be in attendance at the meeting, and calls attention to the fact that matters of great importance, not only to the interest of Ohio but to the fraternity at large as well, will be discussed thereat.

The Association will be glad to welcome any of the brethren who may wish to pay a visit to the sessions.

JOS. BATE,
Secretary.

THE GAS REFORMERS OF NEW YORK CITY.

One of the leading ambitions of the average New York citizen, and particularly so of the "fussy" person who desires to acquaint his neighbors with the important fact that he is a "self-made man," is to set himself up as a reformer of something or another. His most ardent predilection is in the direction of "investigating abuses known to exist, and which are honeycombing our municipal system," etc. When municipal affairs present nothing of a suspicious nature, he must venture out in search of "other weighty matters that are pressing heavily upon the best interests of our citizens," etc., giving a great portion of his valuable time, to say nothing of an endless amount of "concentrated thought," to the devising of schemes whereby all these "oppressions may be corrected." New York city's political governors and machine regulators having been walking over the straight path of late, the "reformers" had to make choice of a side-issue this season, and accordingly selected the Consolidated Gas Company as a proper and fitting object whereupon to exercise their wonderful talents.

One peculiar faculty attaching to the professional reformer is his intimate knowledge of every known business and profession; suppose he has amassed money trading in leather; he regards that as conclusive proof that he knows all about meters—for is there not leather in meters? We might possibly infer from this, cognizant as he is about there being "leather and leather," that is why he is so prone to disbelieve in the meter's accuracy. The reformer who has traded for a life-time in sugars knows how matters will sometimes "go wrong" with a shipment; therefore is he ready to believe that the gas man does occasionally "mix things up." Indeed he is measurably certain that the big gasholders are inflated with air, and that the retorts and generators are but a well-devised sham to put a gasified appearance upon the whole transaction, and bear a similar relation to the manufacture of gas in about the identical proportion maintained by the suburban cow to the urban hydrant or pump in their connection with the supply of our lacteal fluid.

Speaking now in all seriousness as to the movement recently inaugurated in this city for the ostensible purpose of investigating the methods of the metropolitan gas companies, sober-minded persons cannot view the proceedings so far taken other than in the light of an aggravated farce. The principal mover in the premises, John H. Sherwood, a large holder of improved real estate, and also connected with the Fifth Avenue Bank, may be set down at the outset as a "crank" on the subject of gas and gas companies. The very mention of gas is enough to set him agoing; and it is very much easier to start him off on his pet theme than it is to stop him when once in motion. When it was resolved to hold that inauguration meeting at Delmonico's (referred to in our "Market for Gas Securities," of last issue), Mr. Sherwood, according to the daily papers, was the prime mover in the enterprise, and the opportunity of airing himself in the public prints was availed of to the fullest extent. One of the most amusing of his outpourings was contained in the columns of the *Tribune*. To a reporter of that paper he bewailed the iniquity of the recent consolidation in "piling up fictitious capital to increase the enormous taxes annually wrung from the gas consuming public." He dilated upon the rascality of the gas managers who, by greatly increasing the pressure conditions of distribution, compel a "three-foot burner to consume eight and ten feet per hour," and gave it as his unqualified opinion that one-third of the forty millions of capital in the Consolidated Company would be amply sufficient to duplicate its plant. Now, we would suppose that Mr. Sherwood ought to know something about the values of real estate in New York city, seeing that he has amassed a large fortune through operations in the same since "the year of the riot;" and with this knowledge he deliberately makes the above ridiculous statement. Suppose that Mr. Sherwood were disposed to purchase all the freehold property now owned by the Consolidated Company, how much does he think it would cost him? Were he limited to one-third of forty millions wherewith to build his mythical gas plant, being first obliged to purchase the Consolidated's real estate, he might erect a works large enough to supply light to one of his apartment houses, and would find himself hard pressed at that.

But this versatile gentleman is not only a real estate expert and competent apportioner of capital, but, by his own admission, is a gas engineer as well; for he told the same reporter, immediately after his explanation of how a three-feet gas burner could be made to pass ten feet per hour, the following pretty yarn:

"There are two kinds of gas made in New York. One is immeasurably superior to the other in point of brilliancy and candle power; yet the inferior gas is made and sold in large quantities to please old-fogy managers who learned gas making under Murdock, and have added nothing to their knowledge in the last quarter of a century. Do you know that I make gas enough in my cellar to supply this whole house—good gas, too; and it costs me less than I would have to pay the Consolidated Company whose pipes are laid all around me."

Men like General Roome and his confreres are certainly *old* engineers, who have devoted a life-time (and an honorable one) to the study of the principles of their calling; but it is news to us that they "learned gas making under Murdock;" and, from a personal acquaintance covering many years, we are at a loss to understand how they can be considered as old-fogies—unless old-fogyism means a willingness to persevere in the upright and honest methods that they have followed all their lives. But perhaps Mr. Sherwood has "let the cat out of the bag;" for who knows but down in that secret place of his he may have concealed the germ of some great discovery which is to work such a great revolution in our industry that even before its effulgence the brilliancy of Engineer Crutchett's "Steam Carbon Gas" will pale. If this surmise be correct, inventor Sherwood should not let his process longer waste its power for good betwixt the cellar walls and underneath the basement floor of his residence at 115th street and Sixth avenue.

The truth about the matter is this, and the sooner Mr. Sherwood and his brother filibusters can convince themselves of it the better will it be for themselves. The Consolidated Gas Company, of New York city, would only be too willing to have the law regulate its course in every particular. But such regulations are not to be framed in a day nor in a year; and neither are their germs found in the stupidly idiotic trash recently presented before the Assembly and Senate now in session at Albany, by Messrs. Roesch and Cullen. The clauses of the acts submitted by the representatives named are so absurd that our space would be simply wasted did we try to present them before our readers.

If it be the honest and sincere desire of the organization calling itself the "Gas Consumers' Association of the State of New York" to attempt to govern the gas industry of this State by the enactment of laws equitable alike to consumers and producers, let them start in by asking for the appointment of a commission whose sole duty shall be the framing of measures that shall act to the just protection of all the interests concerned.

THERE WILL BE NO CONFLICT IN FUTURE.

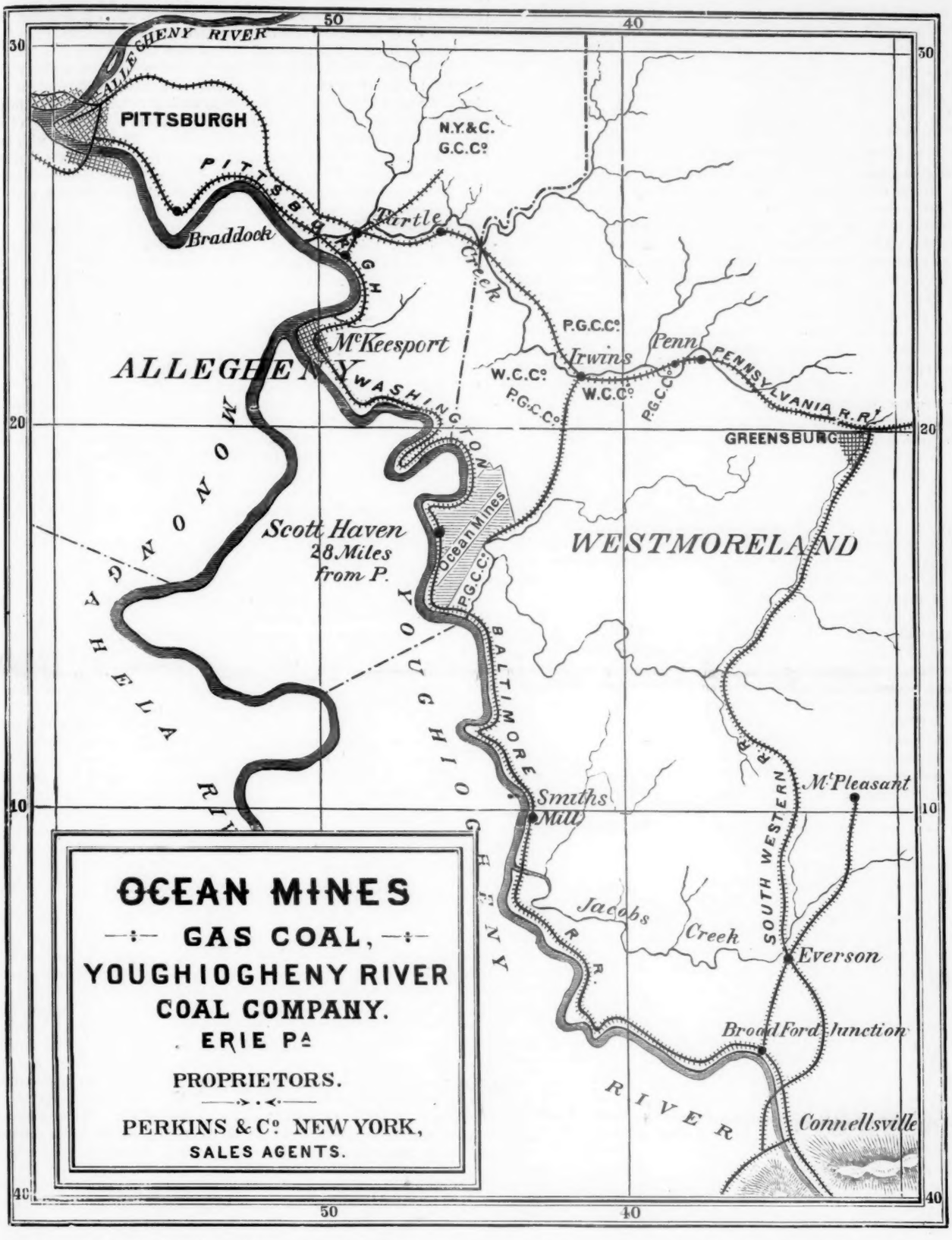
In our last issue the circumstance of the unfortunate conflict of dates between the days set apart for the respective meetings of the New England and Ohio Gas Associations was pointed out, and we felt called upon to express our regret at the fact. We also ventured upon making the assertion that no such *contretemps* would take place in respect to next year. That our prediction was correct is borne out by a letter since received by us from Mr. Jos. Bate, Secretary of the Ohio Association. Mr. Bate says that the matter had been noticed at the Springfield session of the Executive Committee, but arrangements had so far progressed at that time as to render any change in the previously chosen date quite impossible. The gentleman assures us that the future arrangement will be of a nature calculated not to interfere in any manner with sessions of other Associations. Secretary Bate gives us authority to make the above statement.

THE LATEST FROM BOSTON.

In our issue for December 16th it was stated that the Board of Aldermen whose term of office expired with the close of 1884 had left as a legacy to their successors the disposal of the question as to whether or not the particular brand of opposition, labeled the Bay State Gas Company, should have the right to construct and operate a plant in Boston, Massachusetts. [People in this section of the country should not confound this Bay State Company with the Shoe and Leather Company. They are not in any manner identified with one another. The Bay State gas financiers are engaged in an attempt to "divide" the earnings of old established gas plants in large cities; while the Shoe and Leather Company are large employers of convict prison labor.] The heirs to the legacy have disposed of their patrimony in short order. When the new Board got into proper working harness the petition of the Bay State people was at once taken up. At one time it looked as though the measure would be favorably acted upon without a reference to the Paving Committee; but eventually such a reference was ordered, we believe on date of January 26th—it may possibly have been a week earlier, as our advices on this matter are somewhat meager. At the Board meeting of Feb. 2d the Paving Committee handed in a report on the question. The chief points claimed to have been considered in the deliberations of Committee were, "Will the admission of a company to compete with those already enjoying the privileges asked for be for the public good? And is the petitioner a proper company to which to grant these privileges?" The deliberators found no difficulty whatever in disposing of the questions in favor of the petitioners. Indeed they go so far as to say, "It is evident to your committee that the advantages to our citizens are very great in admitting a competing company, while it will bring into our community a large amount of taxable property, and result in the circulation of a large amount of money among the unemployed laboring classes." In other words, the Committee find that it will be a good thing to plunder the Boston Gas Company in order that Boston's tax valuation may be increased by a trifle, and the "unemployed laboring classes" are voted as worthy of a share in the operation. The report of the Committee was accepted, and the order granting leave was laid over for one week. A telegraphic despatch received by us late on Tuesday, February 10th, through the courtesy and attention of a friend, informs us that the order was passed at meeting of Board, held on February 9th. As near as we can make it out now, the case at present stands thus: The Consumers Company claim the right to go ahead, despite the veto of Mayor Martin—see JOURNAL, December 2d and 16th; and the Bay State Company have just been granted Aldermanic consent to proceed with their scheme. Take it all in all, it looks as though there were "piping times" in store for the Hub.

A MISPRINT.—In our last issue (February 2d), on page 58, first column, twenty-sixth line, commencing, "supplants 52 gas lamps," should read,—"supplants 5.2 gas lamps."

PROGRESS.—Six years ago China had only 6 miles of telegraph lines in operation. Now Canton, in the South, has been brought into direct communication with the chief city in the North. A message from thence to New York could be delivered in the space of five hours.



Map Showing Location and Surroundings of the Youghiogheny River Coal Company's Ocean Mine Gas Coal.

The Ocean Mines are located in the center of the world-famous Youghiogheny Coal Field, and cover and area of three thousand three hundred (3,300) acres, showing a total productive capacity of thirty-six million (36,000,000) tons. The Youghiogheny Coal has justly earned the reputation of being the *best American Gas Coal* obtainable; and attention is called to the fact that the facilities possessed by the proprietors of the Ocean Mine are unsurpassed by those of any other colliery in the United States. See advertisement of Ocean Mine Youghiogheny Gas Coal on page 108 of this issue. Full particulars on application to PERKINS & CO., General Sales Agents, 228 N. Y. Produce Exchange. P. O. Box 3695.—*Adv.*

[From Journal of the Society of Arts.]

On the Use of Coal Gas.

By Harold Dixon, M.A.

[Below will be found a reprint of the third and concluding lecture delivered by Mr. Dixon before the Society of Arts, London, England, on date of Monday, Dec. 15. For previous lectures by the author on this topic see Journal, issues of Jan. 16 and Feb. 2.]

Lecture III.—Coal Gas as a Source of Heat.

With your permission, I should like to say a few words, as a preliminary to this lecture, on a subject that has been much debated—the effect of haze and fog on different sources of light. Some of this audience are aware that experiments have been carried on during the past year at the South Foreland on this subject, and that various illuminants have been tested with regard to their penetrative power through mist and fog; and although the investigation is not over, and I am not in a position to give precise results, I can make a few general remarks on the subject. I am often told—"So, I hear the electric light is absorbed by a fog; it is no use." That statement is not really correct. The electric light does go through a fog as well as another light, if it is as bright in the red rays—the less refrangible rays—as the other light is. There is a popular fallacy, and many writers commit it, in supposing that the absorption of light is independent of the quality of the light; whereas the absorption of light takes place selectively, just as the absorption of heat takes place selectively. When a beam of heat falls on a plate of glass it suffers a certain percentage of absorption; the beam which has filtered through the first glass suffers less absorption in passing through a second plate of glass, and still less in passing through a third. And in the same way Professor Langley has shown that light suffers a selective absorption. Where a beam of light passes through any medium, such as a plate of glass, it suffers a certain percentage of absorption; the beam of light which has passed through the first suffers a less percentage of absorption in passing through a second plate of glass, still less in passing through a third, and so on. In other words, the beam, when it has lost its absorbable constituents, then suffers less than it did at starting.

Now the bearing of this with regard to the penetrative power of the electric and other lights is this: If the electric light is stronger in the long rays than another source of light, produced by gas or oil, and it passes through a certain thickness of haze, it loses its absorbable constituents, but the residual light is stronger than the residual light from the other source, and therefore that residual light will pass further through haze than light from the gas or oil. But if the two are of equal intensity to start with—that is to say, if the two equally affect a photometer disc—and the two lights pass through a certain thickness of haze, then the electric light loses more of its constituents than the oil or gas light, and therefore the residue is less strong than the residue of the gas or oil. Taking, then, two lights of equal intensity, one electric and the other gas light, the latter will go further through haze. But if the electric light is very much stronger, as electric light can be made, than any gas flame or oil flame, then, in spite of its greater absorption, it will go further than those other weaker flames.

I said that there was a fallacy in the usual way of expressing the absorption of light. The fallacy consists in regarding the absorption as *regular*. If a is the intensity of the source of light, and x the fraction of that which passes through one layer of haze, and y is the number of layers through which it passes, then it is ordinarily said that the light which passes through any number of layers, y, and comes to the observer's eye, is expressed by ax. But in reality the absorption is not regular. The loss of light is greater at first, and becomes less and less as the shorter waves are filtered out of the beam.

When a gas flame burning in air is allowed to mix itself with air, it loses light. I showed you experiments last week in which coal gas, forced out through a small orifice at high pressure, mixed itself with the air, and gave less light than when it flowed with a gentler stream through the opening. Now, if we mix air with the coal gas before it reaches the orifice, we also find that it gives less illumination. A burner has been constructed which is commonly called by chemists a Bunsen burner, after Professor Bunsen, of Heidelberg, but is now usually referred to as an atmospheric burner, in which air is mixed with coal gas before it is burnt. On the table there are several of these burners, made of a straight piece of metal pipe, with orifices near the bottom; the gas issues from a small hole into this straight pipe, and, passing upward, draws in a current of air through the holes—two or three, as the case may be—in the pipe. The coal gas thus mixes itself with about twice or two and a half times its volume of air, and burns with a non-luminous blue flame. The Bunsen burner gives a flame which will deposit no soot on any solid body held in it; it gives a flame with hardly any light, its non-luminosity, of course, being dependent on the fact that no carbon is separated in the burning of the gas. To get a luminous flame, the hydrogen of the hydrocarbons in the coal gas must burn before the carbon; the carbon must be separated and strongly heated up before it is finally burnt to carbonic acid. In the Bunsen burner the carbon and hydrogen burn together; the hydrogen does not have that start of the carbon which it has in the ordinary flame. But, although we are very familiar with this Bunsen flame, the reason of it is not so obvious. It used to be always explained in this way: The oxygen of the air, being allowed to mix with the coal gas before it issued, burnt or oxidized the carbon straight to carbonic acid, without giving it a chance of existing in the solid state unburnt. But although that is a partial explanation, it is not the whole matter. Here is a pipe with the holes at the bottom closed, so that no air can get in; the gas is burning with the ordinary luminous smoky flame. If, instead of allowing air to enter the flame, we pass in some gas which will not aid the combustion, such as carbonic acid, we find that the flame loses its light and becomes very much like an ordinary Bunsen flame. I have here attached a Kipp's apparatus for generating carbonic acid, so that I can pour carbonic acid into the stream of gas, and let the two burn together. You notice that as the carbonic acid mixes with the coal gas the flame loses its light, turns blue, and is hardly distinguishable from the flame of the ordinary atmospheric burner. Now this effect cannot be due to the oxidation of the carbon by letting in air, but only carbonic acid. If I continue to increase the supply of carbonic acid, the flame gets bluer, and is finally extinguished. The air which is admitted to a Bunsen burner acts not only by oxidizing the carbon directly to carbonic acid, but also by this dilution of the coal gas; and the effect of the carbonic acid, I think, in this experiment is twofold: it dilutes the gas—it separates the particles of the gas from one another—and it also cools down the flame. Both causes tend to destroy the illuminating power of the flame. In the first place, the dilution, by increasing the distance between the carbon atoms, prevents their aggregation; and, secondly, the presence of this inert gas, taking no part in the combustion, absorbs heat, and therefore cools down the flame. Both these effects are found in the Bunsen burner, besides the oxidation.

I think, then, the reason why the Bunsen burner is not luminous is, first, that the carbon is oxidized by the oxygen of the air let into it; secondly, that the coal gas is diluted by the nitrogen of the air admitted; and, thirdly, the flame is cooled down. The Bunsen flame is not cooled below the temperature of the luminous flame—it is hotter than the luminous flame; but it is cooled down below the temperature of a gas flame mixed with undiluted oxygen. When a little pure oxygen is mixed with coal gas, it burns with a more luminous flame, owing to the increase of temperature in spite of the direct oxidation of some of the carbon. I can show you an experiment on this point, proving that the mere presence of a small quantity of oxygen is not sufficient to weaken the luminosity. Here is a burner with a supply of coal gas, in the center of which a small tube is fixed, through which I can bring a supply of oxygen to the flame. I gradually bring into the flame a little oxygen, when we see that the intensity of the light is very much increased. It is evident that the mere presence of oxygen in the flame need not necessarily, by oxidation, destroy the light. Now, I increase the supply of oxygen to this burner, and we find that as the oxygen increases the light gradually diminishes, and we shall finally get a small non-luminous flame of a very high temperature. As the oxygen is turned up, you see the character of the flame is altered. It no longer gives light; it burns with a blue-violet flame, and the tip is green.

The high temperature produced by the burning of coal gas, either in air or oxygen, has been utilized for producing an artificial light. Let me show you one or two simple experiments on the temperature of this flame. Platinum you know is a most refractory substance, melting at the highest temperature of any known metal. On introducing a spiral of platinum wire into this flame, it is immediately melted. Here is a little cylinder of lime, against which the non-luminous flame is caused to impinge; and here we have the well-known lime light, or Drummond light. Now, two burners not dissimilar to this in principle have lately been devised, one by Mr. Lewis and the other by M. Clamond, which depend on the high temperature produced by the burning of coal gas in a supply of air. I will turn off the oxygen from this coal gas flame, and instead introduce a blast of air. The temperature produced by this means is of course not so high as that which you saw melted the platinum readily, but still we get a very high temperature. When the air is blown in we get a non-luminous flame, and if I introduce a bit of platinum, of the same thickness as was melted just now, it gets heated up to a bright red; with a rather thinner wire the light emitted is much whiter. This in effect is the platinum lamp of Mr. Lewis. I have not got, I am sorry to say, the lamp itself to show you; but it is made by blowing air into a coal gas flame and letting it play on a little cage of platinum wire in exactly the way I showed you just now; only I believe he has succeeded in making the blast of air enter the flame without producing that hissing noise, at all events not in so marked a degree as you heard just now. I have only once had the pleasure of seeing the Lewis gas supplied on a large scale, and then I do not think it was quite free from the hissing noise—it was just noticeable. I believe Mr. Lewis is now lighting some of the stations

on the Underground line, and probably many of my audience are more familiar with the light than I am myself. In the Clamond light the chief difference is this—that magnesia (the oxide of magnesium) is heated up by the blowpipe flame; for it is nothing but a blowpipe flame—a current of air blown through coal gas. Magnesia, like lime, glows, when heated, with an intense white light. Of course the chief objection to both these burners being brought into large use is this—that a supply of air at high pressure is necessary, so that either one must have a blower to send in the current of air, or else a double set of mains must be laid down from the central supply.

The two flames we have considered—the luminous gas flame and the non-luminous Bunsen flame—have both their uses, the one chiefly as a source of light, the other as a source of heat. The luminous flame I have already discussed, and I want now more fully to consider the applications of the non-luminous in heating and cooking.

We have seen that when a solid substance is placed in the non-luminous flame it glows brightly, and gives out far more light than the non-luminous flame itself. Without any artificial supply of air under pressure, this Bunsen flame will heat up a coil of platinum wire to a bright incandescence. The luminous gas flame containing solid particles of carbon will radiate heat much more strongly than a non-luminous Bunsen flame. Heated gas by itself is almost incapable of radiating heat. Solid particles are necessary for radiation. Now, in the ordinary flame we have solid particles of carbon, and it is the solid carbon which gives the radiant heat. In the non-luminous flame we have no solid particles, and we therefore have very little radiant heat. But if we consider the temperature of the flame alone, we find that a Bunsen flame is of a higher average temperature than the luminous flame. It gives out, actually, the same quantity of heat when the same quantity of gas is burnt; but since in the Bunsen flame the combustion takes place in a smaller space, the average temperature of the flame is higher, so that a coil of platinum wire held in it will be raised to a higher temperature than if held in an ordinary luminous flame. Now, the Bunsen flame may be used as a source of radiant heat, by heating up a solid body, such as platinum, fire-brick, asbestos, or other incombustible substance. The Bunsen burner may also be used as a source of heat by applying the flame directly to a vessel in which water or other material is contained. If we want to boil water, certainly the easiest and cleanest way is to place a kettle over a Bunsen flame; no soot is deposited, for there are no solid particles of carbon in the flame, and the kettle remains clean.

Of the various kinds of Bunsen burners which have been devised to heat water, those constructed by Mr. Fletcher, of which I have several specimens here, seem to me to be admirably fitted for that purpose. I have no doubt that others may be as good, but I am not so well acquainted with them. I have here two specimens of the simplest form of burner, in which the gas flowing from a small pipe creates a partial vacuum, and draws in the necessary supply of air, so that the air and coal gas mix in the base of the burner and then burn with a non-luminous flame. These burners are very easily regulated; you can get a very small flame or a very big flame as required. For the purpose of cooking, this Bunsen burner seems to be most admirably adapted, wherever water is to be boiled, or wherever food is to be baked or braised; but there is a difference of opinion with regard to roasting, and I do not feel myself in a position to be able to lay down the law at all on this subject. My chief experience with regard to cooking has been with a Bunsen burner. Now, a Bunsen burner will roast meat very well, provided that the products of combustion are not poured straight on to whatever is being cooked; the flame must be used to heat up the walls of the roaster, and the radiant heat from the walls must roast the meat. Such, I think, is the right way in which to roast meat if you use a Bunsen burner; do not place the joint straight over the top of the burner, so that the carbonic acid and steam pass directly on to the meat, but have the burners arranged alongside the walls of the roaster, and so heat up the walls as to cook the joint by radiant heat, and not simply by heated gases. In some forms of gas ovens the air inside the oven is heated up, and this air, with the products of combustion of the coal gas, bakes the joint; but that, I think, is not the best way of doing it. The other way is to allow a constant supply of air to pass through the roaster, coming in at the bottom and passing out at the top, mixed with the products of combustion, and to cook the joint by the heat radiated from the sides of the roaster.

By the kindness of Mr. Fletcher I am able to show a stove—a kitchener, perhaps, I should call it—in which the Bunsen or atmospheric burner alone is employed. The roaster itself is quite open at the bottom, so that a continual supply of fresh air is sweeping in, and passing out at the top with the products of combustion. There are two small rows of gas burners heating up the opposite sides of the roaster, and the radiant heat from them roasts the joint between them. On the top of the roaster three burners are placed, over which kettles and saucepans may be boiled. Underneath these burners, between them and the roaster, is a space for cooking chops or grilling steaks, and so on. One of these burners is made to rotate, so that the flame can be turned either upward or downward. When you want to grill, the burner is turned over; the iron is then above the flame, and becomes strongly heated, and the radiant heat from it grills the chop. On turning the burner over, the flame being above, it can be used for boiling or braising.

Now, in an arrangement where such a gas stove as this replaces the ordinary kitchen fireplace, I venture to think that great economy will be found; not that coal gas is so cheap that we cannot get a greater quantity of heat by burning coal of the same value, but because the whole thing is so clean and easy to work. First of all, we have no pouring of coal into the cellar, we have no digging of coal out of the cellar, we have no dust and cinders to clear away; secondly, the stove is only alight when it is required. It is not necessary to keep the kitchen fire burning all day, because you can light the gas in a moment, and in ten minutes it is ready for use. The third advantage of the gas system in the house is this—that you do away altogether with I may call the *bete noir* of domestic life—the kitchen boiler. With water as we have it supplied in England, with a certain quantity of magnesium and calcium salts dissolved in it, the kitchen boiler has a crust continually forming on it, and it requires periodical cleaning out. Unless this is done there is always a danger of the fur blocking up the supply pipe, and causing a dangerous pressure of steam. Another danger, too, may occur; the crust forms all over the inside of the boiler, and increases day by day as the water is heated in it, and may become of such a thickness that the iron of which the boiler is made, being cut off from contact with the water, may become red hot. If, then, some of the fur breaks off, the water may come in contact with the red hot iron, and the sudden evolution of steam consequent on that may be sufficient to burst the boiler. Now, in an arrangement which I should recommend, the kitchen boiler is done away with altogether, just as the kitchen fire is done away with in favor of the gas oven. Hot water is obtained where it is wanted by a therma, or water heater—one upstairs for baths, and another downstairs for washing. By the kindness of Mr. Sugg I am able to show you here a very perfect specimen of the water heater designed by Mr. Vernon Harcourt. In it a ring of gas burners is lighted at the bottom; at the top the cold water flows into a sieve, whence in passes in fine spray, and falls on a metal plate; through the middle of this metallic plate it passes through an orifice on to a second plate; it flows along that and falls off around the circumference on to a third plate, through the middle of which it passes, and so on. The products of combustion—the steam and carbonic acid—from the coal gas pass upward through this series of waterfalls, and the heat of the gas is thus absorbed by the water, the products of combustion passing off at the top quite cool. The supply of gas and water must be so regulated that before the water reaches the bottom it is raised to the temperature required—about 110° or 120° F., which is sufficiently hot for ordinary purposes, for a bath, or washing up dishes. In this way, in ten minutes a bath may be supplied with hot water; no iron pipes need pass through the house from the kitchen upstairs, because the water is heated *in situ*. A similar therma may be placed in the kitchen, where hot water is required, perhaps, more abundantly than upstairs. With these devices—the hot water apparatus and the gas stove—the burning of coal for cooking and heating is quite got rid of.

I ought, perhaps, to say a few words on the other system of roasting by gas—that of heating by radiation direct from the gas flame. That is the method which has been used by Mr. Sugg in his gas kitcheners. His, I believe, are generally made of copper. He has two rows of luminous gas jets, one in front and the other behind, and the joint is made to turn on a spit between them. In this way the radiant heat of the luminous flames roasts the joint. He claims for it that the joint has a better flavor than it has when it is cooked by a Bunsen burner. My own experience is that joints cooked in Mr. Fletcher's stoves have a most excellent flavor, certainly quite as good as when roasted before an ordinary fire. I have tasted joints cooked in gas ovens—improperly cooked, because the supply of air was not sufficient; the meats were really baked in that case by hot air, and were not roasted by radiation, and I think that made all the difference. In these roasters the meat is entirely cooked by radiation. That all the dainties I propose to show you cooking in this stove will turn out successfully, I will not venture to predict, because I am a very inexperienced cook; but I may say this, that a bachelor may grill a steak or a chop with a gas stove and be perfectly satisfied with it. In this gas kitchener I have been roasting a leg of mutton, baking potatoes and a fruit tart, and making tomato soup, and if those who are experienced in domestic cookery will kindly pronounce upon them afterwards they shall be placed at their disposal.

Just a word or two about the ventilation of rooms by the ordinary English method of a coal fire, aided by crevices under the doors and in the window sashes, and the system of ventilation and lighting a room at once as it can very well be done by coal gas. The ordinary method of ventilating a room I have called the English method—an open coal fire aided by the crevices under the door—because in the vast majority of houses we go into in England we find that such is the only method of ventilation provided.

What happens in such a room as this? If the fire burns well it will draw in some thousand cubic feet of air an hour, a little more or less, and that will

be supplied not from the general air of the room, but from the lowest stratum of air in the room, that on a level with our feet. The air in the upper part of the room will remain unaffected, and only the air low down near the floor will be drawn into the fire. Now the air which flows in to fill this space will pass in under the door, through the key-hole, or any other small crack where it can find entrance, and many colds and unpleasant consequences are produced by this method. It does produce a draught certainly in the room, but it does not change the air we are breathing so well as if we had a very much smaller ventilating power placed in the upper portion of the room. Now, if a room were lighted with such a regenerative burner as I showed you last Monday, where the air was continually drawn in to feed the coal gas flame, and then, mixed with the products of combustion, passed away through a pipe, we should have a continual change of air in the upper parts of the room—exactly where the change is required. The heated products of combustion of any flame in a room, be it candle or lamp or coal gas, are lighter than ordinary air, and pass up to the ceiling, and so does the breath from the people in the room. The consequence is that in an ordinary room the impure air is near the ceiling, and the purer air near the floor. It is not important to change the air near the floor; it is important to change it in the upper part of the room. Now, a gas burner in which the products of combustion are drawn away, does so ventilate a room by changing the air at the top. Where a burner carrying off its products of combustion cannot easily be placed in a room, it is easy to place a ventilator near the cornice to carry off the vitiated air. The heated gases from the gas flame, or whatever other flame is used to light the room, must pass towards the ceiling; and if we give them there an orifice to escape by, they will escape by it. But we must remember one thing; one must supply continually a stream of fresh air to take the place of the air so drawn off, and we must not allow the air to force itself in through nooks and crannies and so produce draughts. What we want in ventilation is a large body of air flowing gently through a large opening. In this way draughts are avoided, and the fresh air spreads itself out quietly throughout the whole room. I think one of the best systems of ventilation is that in which the in-currents of air are brought up by a large pipe and allowed to flow out some 7 or 8 feet from the floor. As it is brought into the room it has an upward flow which throws it out towards the ceiling. Such a current of air will not have sufficient force to flow right up to the ceiling and mix with the products of combustion and hotter air derived from the gas flames, but it will form a layer under these, and will then gradually subside all over the room. Some of it will, of course, be drawn to the gas burner and will there be burnt, and it will then pass to the ceiling. Another portion will pass downwards and feed the fire, and that will pass up the chimney. The important part of such an arrangement is this, that the fresh air is brought in at two-thirds of the height of the room, and spreading itself out evenly over the room, feeds both the gas flames and the fire, and the people in it. Now, in such a system of ventilation the gas flame in the room plays an important part. Even if we cannot have that which I think is the best system, a regenerative burner, carrying off its products of combustion, and so producing an artificial ventilation, we can have ordinary gas burners and orifices near the ceiling to carry off the heated air.*

Among the apparatus for heating and ventilation worked by gas is one which works very successfully, called the "Lux Calor;" it gives both light and warms the air. In the center is a ring burner. The products of combustion pass upwards, and then turning over, pass downwards through the annular space between two metal cylinders. These cylinders are in contact inside and outside with the air of the room, so that whatever will be condensed out of the products of combustion by cooling are condensed in the apparatus. We find that water, mixed with some carbonic acid, and a small quantity of sulphurous acid from the sulphur of the coal gas, flows in drops from the bottom of the apparatus. Air is continually passing through the cylinders, and is warmed up in its passage. The cylinders between which the hot products of combustion of coal gas are passing heat up the air in contact with them, so that the air becomes lighter than the corresponding column of air outside and rises. Accordingly we have a continual draught in of fresh air at the bottom, and warm air passing out at the top. It does not come anywhere in contact with the products of combustion of the coal gas, but merely in contact with the hot sides of the cylinders. The air then in the room continually passes through these copper cylinders and so becomes warmed. The apparatus may also be arranged so as to bring in a supply of fresh air from the outside of the house, and warm it in bringing it in. At the back of the apparatus is a hole to which can be attached a pipe from the outer air, and through this pipe the air is drawn; it would pass through this system of cylinders, and is warmed in its passage. The burner itself having a glass sheet in front, or else being open, gives light, and the whole apparatus may stand in a passage or office, and both light and warm the air in it.

Now I am not so thorough-going an advocate of coal gas as to wish that our coal fires should be entirely abolished. I confess that I like poking a fire, and I know many people share my prejudice; but there are many rooms (bedrooms, for instance) where one would be very glad to light up a fire on going to bed, or on rising in the morning, without the trouble of having a coal fire laid. For such a purpose I think an asbestos fire answers most admirably. It is made in this way: One has an atmosphere flame—that is to say, coal gas mixing itself with air, and burning with this non-luminous flame, and in the flame is placed a fire brick or asbestos, or some incombustible substance. On the table I have such an asbestos grate. In the front of it is a pipe bringing in the coal gas, so that the atmospheric flame plays over a quantity of asbestos fastened in between the crannies of fire brick placed at the back of it. It is lit in a moment; it gives out plenty of radiant heat, which is the kind of heat we want; and I think it presents a very agreeable appearance. And not only that, it serves perfectly well for boiling a kettle, which can be placed in front of it on a little hob provided for the purpose. What we want in a fire-place chiefly is radiant heat. We do not want the Continental gas stove, which gives us simply hot air in the room. English people are accustomed to be warmed by radiation, and to live in cool air. It oppresses us to pass into a room where the air is heated; we like to inhale cool air, but we like to feel the wall and other objects in the room to be warm. This, of course, is effected by radiation. Radiant heat passes directly through ordinary air without heating it in any appreciable degree; air is only heated when it comes *in contact* with hot substances. Now, such a fire as I have on the table gives out radiant heat through the device of placing in a non-luminous Bunsen flame a solid substance which is raised up to a bright red heat, and then radiates heat. Such a stove, I think, is suitable for many rooms in a house not frequently lived in. I do not think it is quite a satisfactory substitute for a sitting-room fire. But consider for a moment what the effect would be if the kitchen fires of al London houses were abolished, with their boilers and other abominations, and if one-half the other fires were also abolished and replaced by such stoves as I have shown you this evening. These stoves have been standing in the room unconnected by any pipe to the chimney, and nobody can see any products of combustion coming from them. The coal gas in them is perfectly burnt, and passes away as steam and carbonic acid. With such heating arrangements as these we should have no smoke, and with no smoke in London, we should have no London fog. We should have fog, but we should not have that particular article called "London" fog, in which the particles of moisture which make up the mist become coated with a carbonaceous, sulphurous cuticle. This acrid, sooty scum is that which gives it that particular character which has earned the London fog its notoriety. The English Channel has quite as many fogs in it, perhaps more than London has, but the fog in the English Channel is a clean white mist; it wets you a little, but when it has passed away you are none the worse, whereas London fog, owing to this cuticle of dense smoke upon it, is one of the most deleterious things of modern civilization. Now, the moderate use of coal gas would very greatly, I think, diminish the evils of the London fog, and I think it would not at all diminish the comfort of our houses. I think that such a stove as Mr. Fletcher has lent me this evening, and with such a heater as Mr. Harcourt has devised, we might get on very comfortably in our houses; and I think with such an asbestos stove in our bedrooms we should be more comfortable than we generally are. At the same time we should have the satisfaction of knowing that we were preserving the atmosphere free from taint, and not choking our neighbors with our kitchen smoke.

In bringing this course of lectures to a conclusion, I have to thank the gentlemen who have so kindly placed their apparatus at my disposal, especially Sir James Douglass, for that brilliant lighthouse burner he lent me; Mr. Fletcher for these stoves and burners; Mr. Sugg for many admirable burners; and Messrs. Ritchie for this heating and lighting stove; and to all of you for the very great attention with which you have listened to me.

A vote of thanks to the lecturer having been passed unanimously, on the proposal of the Chairman, Mr. B. F. Cobb, Mr. Harold Dixon said:

By way of reply, perhaps I may read a short abstract from my note-book of the cost of such a system as I have attempted to explain to-night of cooking and heating entirely by gas. These figures are obtained from the house of a friend of mine in Oxford, whose hospitality is well known, and whose table, as I can vouch for, is of the best. He tells me he has done all his cooking for the last three years in a Fletcher gas roaster, and he has heated all the water used in his house in a therma similar to this, not the same, but one of Mr. Fletcher's; and in his kitchen he has adopted a boiler something like a large saucepan with a coal gas flame underneath. The cost of that, on the average for a household of eleven persons, including twelve gas burners,

* At the end of the first lecture of this course there is an omission which I take the opportunity of supplying. In speaking of the formation of sulphuric acid from the sulphur in coal gas, I said that no condensation of steam, and consequently no oxidation of the sulphurous acid, could take place in a room to which the necessary air supply was maintained. I omitted to state that the air supply for ordinary ventilation should be such as to keep the quantity of carbonic acid present in the room below a certain small *maximum*. If 10 cubic feet of gas are burnt per hour in a room of 2,500 cubic feet capacity, the whole of the air must be renewed once in two hours, in order that the quantity of carbonic acid in the atmosphere of the room may not exceed .5 per cent. If the ventilation is such as to cause this renewal of the atmosphere, then the steam produced by the burning of the coal gas will not exceed 1 per cent. of the atmosphere, and will pass away uncondensed.

because he employs gas in the kitchen, scullery, passage, hall, and consulting-room, is £28 a year. This is an average of three years' consumption. It seems to me, if one considers what is the average amount of coal burnt in a kitchen fire for a family of 11 persons, and consider what the coal gas burnt at twelve burners constantly alight is, that the sum becomes exceedingly small. The following is the list of apparatus worked by the gas—one large cooking stove, and one small one, one boiler, five Bunsen ring burners, and two water heaters. This is all done for £28 a year; but I must mention that the price of coal gas in Oxford is only 2s. 8d. per 1,000 cubic feet.

Annual Report of the Edison Electric Illuminating Company.

[Mr. S. B. Eaton, vice-president of the Edison Electric Illuminating Company, of New York city, has presented the following annual report to the stockholders of that corporation. Believing that the figures given will prove how far Mr. Edison has succeeded in accomplishing the job undertaken by him (that of "closing up" the gas companies of New York city) some five years ago, we submit the same without further comment.]

To the Stockholders of the Edison Electric Illuminating Company, of New York City:

Your company has now completed the fourth year of its existence, and your board feel that the results achieved are a fair cause for congratulation as to the past, and for encouragement as to the future.

Your enterprise was one of peculiar boldness. Starting almost from the moment that Mr. Edison had demonstrated the scientific success of his great invention, you undertook to apply practically, and to its fullest extent, a system which had scarcely been tried at all, except in the laboratory, and which, so far as underground and central station work was concerned, existed only theoretically. When the construction of the present central station was commenced there were in use perhaps a half-dozen small, imperfect, isolated plants; and with only these to guide you, you undertook and have carried to scientific and financial success the great problem of underground central station lighting by electricity in competition with gas.

At the date of the last annual report the First District had scarcely more than reached the point where its receipts were in excess of its expenses. During each and every month of the present year they have shown a handsome increase as compared with last year, and instead of a loss, as in 1883, the operations of 1884 will leave a surplus of fully 3¼ per cent. on the capital stock, after paying expenses of every kind.

The following table shows in detail the average number of customers and of lamps connected, the collections, operating and general expenses (including all repairs and renewals), taxes, etc., and the profit or loss for each quarter of the years 1883 and 1884. It will be remembered that prior to February 1st, 1883, the light was supplied, as an experiment, free of cost to consumers.

Month.	Average of customers connected.	Average of lamps connected.	Collections.	Operating and general expenses.	Loss.	Profit.
1883.						
Feb. March..	330	4,374	$3,788 64	$9,904 48	$6,115 84	.....
Ap. My. June.	393	5,931	8,711 89	14,752 28	6,040 39	.....
Jly. Aug. Sep.	439	8,685	15,689 01	15,197 31	.....	$491 70
Oct. Nov. Dec	483	10,172	24,900 11	17,693 08	.....	7,207 03
1884.						
Jan. Feb. Mar	498	10,685	28,659 34	18,229 88	.....	10,429 46
Ap. My. June.	541	11,594	25,400 54	18,148 97	.....	7,251 57
Jly. Aug. Sep.	582	12,503	23,849 34	19,975 88	.....	3,873 46

The financial results of the foregoing table are summarized in the following:

	1883.	1884.
February and March	$ 6,115 84 loss*	$10,429 46 profit.
April, May, and June	6,040 39 loss.	7,251 57 profit.
July, August, and September	491 70 profit.	3,873 46 profit.
Oct., Nov., and Dec.	7,207 03 profit.	14,000 00 profit.†
Net loss, 1883	$4,457 50	
Net profit, 1884		$35,554 40

As a matter of course, the profits of the station fall off considerably in the summer months, as will be seen from an examination of the foregoing tables. To neutralize this falling off in part, your company has undertaken to furnish electric motor fans to be run by current from the central station; and while their introduction last summer was not possible until too late to secure any considerable results, the fans met with such favor as to warrant the belief that next summer they can be developed into an appreciable and permanent source of revenue.

A heavy item in the operating expenses of the First District has heretofore been that of lamp renewals. Owing to imperfect electrical determinations in the construction of the district, and the consequent inequality of electrical pressure, the lamp breakage was unduly heavy. It is very gratifying to state that during the past summer these defects of construction have been mostly corrected, and improvements have also been made in the lamps themselves, with the result of raising the life of lamps from 400 hours of use in January to 914 hours in November, which is equal to a monthly saving of about $400 in operating expenses on the number of lamps in use at the present time.

The average monthly life of lamps during the past year, as reported by the superintendent of the station, has been as follows:

January	400 hours of use.
February	523 " "
March	349 " "
April	448 " "
May	400 " "
June	389 " "
July	502 " "
August	553 " "
September	727 " "
October	730 " "
November	914 " "

The following additions have been made to construction account of First District since January 1st, 1884:

New plant, including two engines, 150 h. p. each; two dynamos, 1,200 lights each; two regulators, and expenses of installing same	$34,125 03
Station apparatus	1,123 01
Street conductors, viz., 3,849¼ feet	17,140 39
House connections and original lamps	2,958 41
Meters	133 31
Tools and implements	22 68
Motors	2,439 00
Office fixtures	59 33
Total	$58,001 16

The expediency of these expenditures, which have only been made after careful deliberation, is best shown in the financial results achieved, which are due in a considerable degree to the fact that the increased expense of running the station, as enlarged, bears but a small proportion to the increase of receipts secured by the enlargement. The station is even now taxed to its utmost capacity, and it is evident that further additions to the existing plant could be made with substantial advantage to the company. In fact, the superintendent of the station reports that there are now on file over 100 applications for the light, of which at least 50, requiring about 750 lamps, would furnish very desirable customers.

Notwithstanding the recent reduction of the price of gas from $2.25 to $1.75 per 1,000 cubic feet, our First District station has not yet lost a single customer, which is the best possible proof that our light, at its present cost (one and one-fifth cents per hour of use for lamps of 16-candle power), is found more desirable and satisfactory than gas even at the reduced price.

Of even greater importance, however, than the enlargement of the First District is the question of starting a district up-town. When your company was organized it was believed that its authorized capital would be sufficient to install both an up-town and a down-town district, but the delays and difficulties encountered with the down-town district were so great that the capital proved insufficient to install it alone, and even now your company finds itself in debt to the Light Company for more than $70,000 for money advanced and balance of license, though against this your company claims certain offsets arising from the increased cost of the First District. In fact, the down-town district has been operated in the face of every possible disadvantage; but your board has believed that it was pursuing the right policy in showing what could be done under all these unfavorable circumstances, hoping thereby to shorten the time when it could enlist the necessary capital for work up-town.

The present district, which is bounded by Wall street, Broad street, Exchange place, Broadway, Sprace street, and the East River, is perhaps the least remunerative of any in the city, being occupied mainly by banking and other offices, which are closed on an average earlier than 6 o'clock, so that the hours of light consumption are very short.

A far richer field for your enterprise would be an up-town district, extend-

* For two months only. The loss for three months would be even larger.

† The profits for December are estimated at $5,500 00
The actual profits for October and November were 8,500 00
Making the estimated total for the quarter, as above $14,000 00

ing perhaps from 23d street to the Central Park, and from Eighth to Madison avenue. Not only would the hours of light consumption be much longer, but, owing to the great cheapening now made in the cost of everything connected with the Edison system, the cash capital required entirely to install and equip a station of light-giving capacity equal to the present one (and situated somewhere within the limits indicated) would be, as appears from preliminary estimates already made, not over one-half the amount spent for the down-town station. It is estimated that during the coming year this latter will earn fully 5 per cent. on its stock, or equal, in other words, to 10 per cent. on the cost at which it could now be duplicated. In an up-town station, where there would be longer hours of light consumption, it seems very reasonable to assume that half again as much profit, or at least 15 per cent. net per annum at the start, could be earned; and were it not for the general depression at present affecting all electric light investments, embracing both the good and the bad, your trustees would not hesitate to come before you at once with some scheme to raise the capital for a large up-town installation. In all probability considerably more than 15 per cent. could be earned in an up-town district; but even on this basis it is felt that with the results already achieved in the First District, the time is near when a successful plan can be formulated for an up-town station, and as soon as one large station is started up-town there can be no doubt that the extension of the system throughout the entire city of New York will follow.

Your present capital stock is the same as at the date of the last report, viz., $1,000,000, made up as follows:

Paid in	$987,010
Unpaid subscriptions	11,490
Stock in treasury	1,500
	$1,000,000

As the fiscal year of the company ends on the 31st of December, it is recommended that the time for the annual meetings in future be changed to the third Tuesday in January, when the actual results of each previous twelve months can be presented in their entirety, without the necessity for partial estimates which at present exists.

Sir F. Bramwell on the Progress of Invention.

[Sir F. Bramwell, President of the Institution of Civil Engineers (Eng.), delivered his inaugural address before that body on date of Tuesday, January 20. For a condensed report of same we are indebted to the London *Journal*.]

Commencing with the improvements effected in girder construction, Sir F. Bramwell referred to the works now in progress at the Forth Bridge; and cited the St. Louis Bridge and the East River Bridge, New York, as instances in which novelty had been introduced. He then passed on to consider the question of harbor construction, dwelling at some length on the principle employed by Mr. Stoney, of Dublin, where cement masonry is moulded into the form of a wall for its whole height and thickness, the blocks having a weight of 350 tons. This subject naturally led into the allied one of sub-aqueous work; and, in connection therewith, tunnelling and boring work generally was dealt with. In ordinary land tunnelling Sir Frederick said there had, since 1862, been great progress, by the substitution of dynamite, and preparations of a similar nature, for gunpowder, and by the improvements in the rock drills worked by compressed air, which are used in making the holes into which the explosive is charged. For boring for water, and for many other purposes, the diamond drill had proved of great service; and most certainly its advent should be welcomed by the geologist, as it had enabled specimens of the stratum passed through to be taken in the natural unbroken condition, exhibiting not only the material and the very structure of the rock, but the direction and the angle of the dip of the bed. Coal-getting machines, such as those of the late Mr. Firth, worked by compressed air, reduced to a minimum the waste of coal, relieved the workman of a most fatiguing labor in a constrained position, and saved him from the danger to which he is exposed in the hand operation. The employment of hydraulic wedges in lieu of gunpowder to force down the block of coal which had been under-cut was one of the means to be looked to for diminishing explosions in collieries. As to accidents in mines, investigations had been made into the probable part played by the minute dust which prevails in dry collieries. The experiments of Sir F. Able had been of the most striking and conclusive character, and corroborated investigations of the late Macquorn Rankine into the origin of explosions in flour mills and rice mills, which had previously been so obscure. One of the earliest workers in this direction was Mr. Galloway.

Passing over the subjects of pile driving, the improvement of navigable canals and rivers, shipbuilding and ordnance, to which Sir F. Bramwell next directed attention, we come to his remarks on the materials employed in construction. On this matter he said: Probably few materials have been found more generally useful to the civil engineer, in works which are not of metal, than has been Portland cement. During the last 22 years great improvements have been made in the grinding and in the quality of the cement. The artificial material, brick, cannot in these days be said to surpass in quality the bricks used by the Romans in this island 1,900 years ago; but as regards the mode of manufacture, and the materials employed, there is progress to be noted. The brick making machine and the Hoffmann kiln have economized labor and fuel, while attempts have been made (which I trust may prove successful) for utilizing the clay which is to be found in the form of slate in these enormous mounds of waste which disfigure the landscape in the neighborhood of slate quarries. Certain artificial stones, moreover, appear at last to be made with a uniformity and a power of endurance. In respect of these qualities they compare favorably with the best natural stone; and still more favorably having regard to the fact that they can be made of the desired dimensions and shape, thus being ready for use without the labor of preparation. Of timber in new countries the engineer commonly is glad to avail himself to an extent which among us is unknown. Owing to the ready adaptability of metals to the uses of the engineer, the employment of wood is decreasing. Many attempts have been made to render timber proof against the two great defects of rapid decay and ready combustibility. The asbestos paint is used to coat the wooden structures of the Inventions Exhibition. To the employment of this it is not too much to say those buildings owed their escape, in last year's very dry summer, from being consumed by a fire that broke out in an exhibitor's stand, destroying every object on that stand, but happily not setting the painted woodwork on fire, although it was charred below the surface. A surface application may not enable wood to resist the effects of a continued exposure to fire; but it does appear that it can prevent its ready ignition.

Dealing with the improvements which have been effected in the production of steel, Sir Frederick said: Eight years since I delivered, at the Royal Institution, a lecture on "The Future of Steel;" and every year that has passed has justified the opinions I then ventured to put forward as to the way in which steel, made by fusion, would supersede iron made by the puddling process. I am not afraid to repeat my prophecy that the time will come when the use of iron made by that process will be restricted to the manufacture of small articles produced by the hand labor of the village blacksmith, for whose art its plastic character and ready power of welding eminently fit it. Probably the first great revelation in steel manufacture was the exhibition of the ingots, with other products, shown by Krupp in the Exhibition of 1851. The making of steel in crucibles is not so satisfactory a mode of obtaining uniformity in large masses as is either of the other two great systems of manufacture—the Bessemer and the Siemens, the two processes which have changed the whole complexion of the iron industry. By the process of Messrs. Thomas and Gilchrist, it has been rendered possible to employ successfully, in the production of steel, iron derived from ores which, prior to the date of this invention, had been found wholly inapplicable for the purpose. In the manufacture of pig iron many improvements have been effected. The mysterious influences that a very small percentage of some material will exercise upon the quality of the great bulk of another material with which it may be united are well shown in the case we have been considering—that of steel—where a few tenths of 1 per cent. of carbon added to the iron suffices to change the iron into steel. We are not surprised, therefore, when we find that other metals may have their qualities improved for many useful purposes by judicious alloy; and in this way the metal copper, so long used in its alloyed condition of "gun-metal," has within the last few years been still further improved by alloying it with other substances, and thus making it into the now well-known articles of "phosphor-bronze" and "manganese-bronze"—very useful materials to those of our members engaged in the construction of machinery. I think the time is not far distant when, following the lead of Sir Joseph Whitworth, all steel in its molten state will be subjected to pressure, not with the object of making the metal more dense, but of diminishing the size of any cavities containing imprisoned gases. If this is not done, then some other mechanical means will be employed to get rid of the cavities altogether, and thus to produce (without variations in the constituents of the steel) a casting that shall be practically, if not absolutely, free from blowholes, and so that such casting, when afterward forged by pressure, and not by percussion, my be thoroughly trusted to contain no latent defect.

In regard to steam engines and boilers, Sir Frederick said it was difficult to point to any great substantive novelty. These machines had, however, been more and more scientifically investigated, and the results of such investigation had been practically applied, and attended with the advantages anticipated. At the same time, the engineer using steam as his vehicle in a heat motor still had to submit to the chagrin of seeing the largest portion of the heat pass away unutilized. This defect had for years attracted the attention of scientific engineers. Extending his remarks on this subject, he continued as follows: There is, however, another form of heat motor which, while vainly essayed during 50 years, has within the last eight years come

into common use, and the application of which, in cases requiring anything up to 30 indicated horse power, is daily increasing. I allude to the gas engine. By a happy change in the mode of burning the mixture, and of utilizing the heat thereby generated, the injurious shock of the early forms of gas engine, and the larger consumption of gas which caused these earlier forms of engine to be discarded after trial, were obviated. In 1866 the French engineer who tried a Hugon gas engine found that 74 cubic feet of gas per indicated horse power per hour were required. This is now replaced by the 20 to 23 feet per indicated horse power consumed in the engines of the present day. With the low price of gas commonly prevalent in England, this consumption does not cost more than some ¾d. per horse power per hour. It may be said that with coal, even at the London price of £1 per ton, I might use a steam engine having the low economy of 8.5 pounds of coal per indicated horse power per hour before I should be called upon to spend ¾d. per indicated horse power per hour for fuel. You would be astonished to hear, however, that in an investigation instituted last year by the Corporation of Birmingham, when consideriug whether they should approve of a proposal to lay down power-distributing mains throughout their streets, it was found, on indicating some six non-condensing steam engines taken indiscriminately from among users of power, that the consumption in one instance was as high as 27.5 pounds, while it never fell below 9.6 pounds, and the average of the whole was as much as 18.1 pounds. This heavy consumption arose largely from a very prevalent defect—that of too great cylinder capacity; for unless a non-condensing engine is admirably designed, and made with the object of using very high expansion, there is nothing so wasteful as the employment of that which the the buyer of an engine looks upon as an advantage—very great cylinder capacity. Even assuming that the user of a gas engine were entitled to compare it with a non-condensing steam engine consuming only some 5 pounds of coal per indicated horse power per hour, and demanding, therefore, at 1s. per cwt., only ¼d. for the purchase of coal, this difference in cost is well repaid by the saving of boiler space, of the wear and tear and of the renewal of the boiler, of the consumption of coal while getting up steam and during meal times, and the saving in the engineer's or stoker's wages. On public grounds, too, there are the advantages of freedom from boiler explosion, and of cessation of smoke production. Engines are now being made to develop 50 horse power; and, when used on a large scale, so that it would pay to have an attendant devoting his whole time, there is no need to work them with illuminating gas from the street mains. They can be driven by producer-made gas on Dowson's system; and, when worked in this way, 1.5 pounds of "culm" will give 1 horse power, and one lad is sufficient to manage a gas-producing apparatus of a size adequate to provide for engines developing 300 indicated horse power.

At the meeting of the British Association, at York, in 1881, I said that unless some wholly unexpected imp ovement were made in the steam engine, those who lived to see the celebration of the centenary of the Association in 1931 would find the steam engine had become a curiosity, and was relegated to museums; for I could not believe steam would continue to be the vehicle for transmitting heat into work. With respect to the power of the tide, however, I for one have been very much fascinated with the scope there appeared to be for engineering in utilizing tidal power, especially where there was a great ebb and flow. But very few businesses needing motive power can allow their plant to remain idle for nearly half the working day; and as there is an objection to remedying this condition of things by working, when possible, both during the night-tide and during the day-tide, this was an obstacle in most cases to the use of tidal power. Further, when it was sought to preserve continuity of action by providing a series of reservoirs, the outlay needed was so large that the mere interest on it would pay for the fuel for a steam engine—I am afraid, therefore, that, except in certain cases—such as the pumping of water into a reservoir, or the charging of so-called storage batteries, or matters of this kind not connected with ordinary manufacture—this source of power is not likely to compete commercially with heat motors until coal is very much dearer. It is not to be wondered at that the proverbial uncertainty of the wind causes motors which have to be driven by it to be disregarded as substitutes for steam engines; but it is well worth considering whether wind motors could not be employed as adjuncts to them.

Touching on the subject of the transmission of power from one part of a machine to another, Sir Frederick acknowledged that many improvements had lately been made. On this point he said: For long distances we have the development of hydraulic transmission; pipes being now laid down for supplying water under 700 lbs. pressure per square inch; we have companies authorized, if not at work, for laying down pipes to distribute compressed air; we have now, by reason of the improvement in gas engines, the ability to lay on power in every town illuminated by gas (which practically means every town and large village); and we have in New York, and in some other cities of the United States, high-pressure steam, conveyed in mains below the streets, to be used both for power and for heating, for which second purpose, however, it should be remembered the contents of a gas main are equally available. There is the rope system at Schaffhausen; and we may take it as clearly established that we are, day by day, becoming more alive to the benefit, where little power is required, or where considerable power is required but only intermittently, of deriving that power from a central source.

The concluding portion of the address dealt with the important subjects of water and gas supply, regenerative furnaces, the development of the mineral oil industry, and the utilization of natural gas. Sir Frederick's remarks on these topics were as follows: Except in the magnitude of the work and the excellence of the design, of which the new Liverpool Water Works now in progress may well stand as a typical example, there is not much to say as regards progress in those water works which are dependent upon storage. In the United States and Canada the waste of water that takes place not only causes the mains to be incapable of keeping up the pressure under the excessive draught, but renders sources of supply insufficient, which would otherwise be ample for years to come. Progress has been made here in the matter of house fittings by which waste has been greatly checked, and the risk of contamination that formerly existed with certain closet fittings is ended. This question of house fittings has always been a difficult one, and cannot be grappled with by water authorities such as those in the United States and Canada—that is, municipal authorities afraid of offending the voter. We owe it, however, to Mr. Deacon, the engineer of an English municipal water authority, that it is now possible to deal with the correction of household connections at a minimum of cost, and, what is equally important, with a minimum of annoyance to the householder. In most of our towns the supply is satisfactory; but, in spite of the alarm raised by the suggestion of double mains, we might do well in many cases, where there is a pure but limited supply, to have a dual system of mains, and thus to distribute the pure water separately and for potable purposes. The Parisians at least have recognized the expediency of thus "sorting" their supply when that supply is of varying quality, and when the best of it is limited in quantity. In cases where there appears to be no thoroughly satisfactory source of water, the experience of the efficacy of iron purification, as practiced at Antwerp, does hold out very considerable promise.

Gas has been alluded to by me under the heads of motors, and of transmission of power and of heat; but I now desire to say a few words in connection with it under its more ordinary aspect—that of a distributed illuminant. In 1862 the price of ordinary coal gas in London was from 4s. to 5s. per 1,000 cubic feet; the illuminating power was such that five cubic feet of the gas burnt in a specified burner in one hour should give a light equal to 12 sperm candles, each burning 120 grains in the hour. At that time the consumer was, as it was facetiously called, "protected" by restricting the company to a maximum statutory dividend Obviously so soon as this dividend was earned all incentive to improvement was removed. One of the few cases in which recent legislation relating to private companies supplying public wants can meet with the approval of the political economist was that which a few years ago first recognized that it would be well for the private company and for the public that the ordinary incentive of increased profit for increased exertion should remain, and that introduced in certain gas undertakings the sliding scale. This provided for a normal price, and a maximum dividend, but allowed the company to rateably increase the dividend in accordance with a decrease in price below the normal. Under this wiser legislation 16-candle gas is sold in London for as little as 2s. 10d. per 1,000 cubic feet. But illuminating gas has to be considered by the engineer under two distinct heads—one, its manufacture and distribution; the other, its utilization. This last, it is true, is but to a small extent in the hands of those engineers who have the charge of the first. Considerable progress has, however, been made of late in illumination; largely, it is true, owing to a greater liberality on the part of lighting authorities, and the use thereunder of multiple burners in street lanterns, but to a considerable extent due to that much more to be desired improvement, whereby a greater amount of light is obtained from the same volume of gas. The regenerative gas burners, and other modes of burning, into which time will not permit me to enter, promise to largely increase (it is said, even to more than double) the candle power per cubic foot of gas burnt. Such improvement as this is undoubtedly of great moment, not only on the score of economy, but on the sanitary ground of diminishing the amount of products of combustion poured into a room in relation to the light afforded therein. It need hardly be mentioned that the decrease in cost and the increase in profits are largely due to the application of chemistry to this manufacture, by which application the former nuisance-creating by-products have been made sources of revenue and fertilizers for our fields.

I have also, in the most cursory manner, mentioned gas as a means of distributing heat. But a word should be said about those valuable improvements in gas furnaces—I do not mean the Siemens furnace—which have enabled coal gas to be applied to the melting of even very refractory metals by means of most inexpensive plant. Nor have I spoken of those other applications where, either burnt with coke (it may be of the very coal from which the gas itself was derived), or caused to raise incombustible bodies to

incandescence, it forms the cheerful and smokeless substitute for a smoky coal fire, or is utilized for the purposes of domestic cookery. In this latter case, however, if absolute cleanliness and ventilation are not preserved, there will (as the unhappy traveler, compelled to temporarily sojourn in the "limited" hotels of the present day finds to his cost) be one universal dirty gas oven flavor impressed upon all his food, be it the homely leg of mutton, or the lordly haunch of venison.

Although it is quite certain that the first suggestion for using liquid fuel (notably tar to aid in heating gas retorts) must date long before 1862, yet the great development of the mineral oil industries since that date has led (and especially in Russia, in whose territory such enormous yields of oil are afforded) to the employment of this material as a fuel in furnaces and in steam boilers. Next to the infinitely divisible forms of gaseous and of liquid fuel comes, as I have said elsewhere, the dust fuel introduced by Mr. Crampton. In the use of any of these three forms regularity of mechanical supply is a condition involved. Any one of these three, therefore, irrespective of all other considerations, is desirable, because it is a means of dispensing with that most unsatisfactory form of labor—"stoking;" dispensing also with the production of smoke, and with the diminution of maximum effect attendant on the hand-feeding of coals, where the condition of the fuel in the grate and its temperature must be ever varying. Having regard to these advantages which are to be obtained in using oil, and to the cheapness of the material in Russia, one is not surprised to find that there are lines of steamers on the Caspian worked entirely by liquid fuel, and that the same kind of fuel is used to fire the locomotives in many districts.

I have mentioned the improvement in small furnaces worked by illuminating gas. But I am not entitled to bring within my period the regenerative gas furnace—that great invention made by our lamented friend, the late Sir William Siemens, with whose name in this matter should be coupled that of his brother, Mr. Frederick Siemens. This latter gentleman, by a course of study, has only recently discovered that so far from the heating power of the flame being increased by its confinement within narrow chambers, and by its being brought into contact with the material to be operated upon, such arrangements only diminish this power; and he has further found that this discovery can be usefully applied in practice by keeping the roof of a regenerative gas furnace at such a height above the earth on which the materials to be heated lie that the flame can traverse from one side of the furnace to the other, free of contact with the roof above or with the materials below. Very excellent economic effects and a high heat have, it is stated, been obtained by causing the outgoing products of combustion to give up their heat to the incoming cold fuel. I have seen such furnaces in operation, making steel by the hearth process; and it is the fact that the chimney has been without a trace of red glow within it.

The natural oils which are used as fuel are rarely employed in the crude state as obtained from the wells, but undergo more or less refining before use. There is another natural fuel, however, which has been discovered in America, and within the last few years largely utilized—this is the gas obtained from wells in a manner similar to that in which the oil is obtained. It is a marsh gas of high calorific power, and is in certain parts of the United States being used very largely for domestic heating, for the heating of furnaces of every description, including those for the manufacture of plate glass and of steel. It is also being employed for the manufacture of lamp or carbon black, and for the carbon points for electric lighting. It is stated that within a radius of 20 miles from the town of Pittsburg, taken as a center, there are 25 wells, each producing 3,000,000 cubic feet per 24 hours; and that the produce of the whole of the wells at present opened up is 100,000,000 cubic feet of gas per day. To my mind this is one of the most perfect fuels which can be imagined. It does not require preparation, but can be and is used in the same state as that in which it issues under high pressure from the wells; it can be mechanically controlled with the greatest nicety, and, when properly burnt, it is entirely free from smoke or similar defects. When employed in the Siemens regenerative furnace, the producer which is necessary where coal is used is entirely dispensed with.

Sir Frederick closed his address by remarking that, even with the severe limitation which he had imposed on himself, he found omissions were inevitable, and concluded by assuring the meeting that during his term of office he would do everything in his power to uphold the dignity, the honor, the usefulness, and the prestige of the Institution.

Hocking Valley (Ohio) Coal.

Saward's *Journal*, in an article on "The Character and Composition of Hocking Valley Coal," says the character of the coal throughout the field is fairly uniform. Taken as whole, it is an open-burning coal of pronounced character, but the lower bench, burned by itself, is somewhat cementing. It is distinctly laminated, and holds a moderate proportion of mineral charcoal. It ignites easily, swells slightly in burning, and leaves a white or gray ash. It is well approved for steam generation, and also for rolling mill fuel. To household use it is admirably adapted, rivaling in this line of service the Block coals of the Mahoning and Tuscarawas valleys. The most important single use to which it is put is iron making. The successful experience of the blast furnaces that have been built in the valley within the last ten or twelve years, and that have made the Hocking Valley coal their chief and often their sole reliance for fuel, leaves no open questions in regard to its adaptation to this important service. As a furnace coal it is not surpassed in the State, and scarcely by any known bituminous coal. It is also used to a small extent in gas making.

In chemical composition, the average of ten mines, including several of the best of the field (the mines being located in Shawnee, and from there westward as far as Nelsonville), is as follows:

Average of Ten Mines of the Hocking Valley.	(*Lord.*)
Moisture	5.93
Volatile combustible matter	36.48
Fixed carbon	52.41
Ash	5.13
Total	100.00
Sulphur	1.19

The best showing from any one of these mines, and also the poorest results from any one mine, are given below—Nos. 1 and 2:

	1.	2.
Moisture	6.61	5.38
Volatile combustible matter	36.40	37.58
Fixed carbon	54.17	51.21
Ash	2.81	5.83
Total	99.99	100.00
Sulphur	.51	1.94

While there is something to choose between the products of these two mines, the figures show scarcely wider differences than we ought to expect from different rooms of the same mine.

The range of the several elements in these ten mines is also shown below:

Moisture	5.26	to 7.09	per cent.
Volatile combustible matter	35.61	to 37.58	"
Fixed carbon	50.92	to 54.59	"
Ash	2.81	to 6.86	"
Sulphur	0.516	to 1.94	"

These figures evidently show one of the very best coals of the State, and beyond question the steadiest in composition of any of the large fields. When it is remembered that each analysis represents all of the seam that is sent out by the miner, just as it is found in the mine from which it is taken, so far as this can be provided for by careful and thorough sampling, it will be seen that the average above given actually and accurately represents the lump coal that is sent out from the central and western portions of the Hocking Valley field.

In strength and ability to bear handling, the coal is somewhat unequal; but the product of the entire field ranks high. The coal of Sunday Creek, Shawnee, and Straitsville, when skilfully mined, is scarcely surpassed in strength by the famous Block coal of the Mahoning Valley. While other portions of the field fall below this standard to a certain extent, the coal that they furnish is at least equal in strength to any other Ohio coal.

The coal is everywhere mined by undercutting and blasting. The "bearing in" is done in the bottom bench of the seam, which is the best part of the coal in several respects. The cost of powder ranges between 3 and 4 cents per ton of coal.

The coal is universally prepared for market by screening. The standard that is generally recognized for the screens is 12 by 6 feet, with 1½ inches between bars. The bars are either steel or iron, and are generally ½ inch to ¾ inch wide on the upper surface.

One-third of the coal sent out by the miner passes through a screen of these dimensions. Of this third, somewhat less than half is slack, which has hitherto been mainly lost. The balance is unequally divided between nut and pea coal, when the latter grade is made. If the pea coal is not separated, the slack is increased to this extent. The nut coal is counted about half the value of the lump coal at the mine. The pea coal does little more than pay for handling. Reduced to percentages, the several grades appear as follows:

Lump coal	66 per cent.	
Nut coal	10 to 20 per cent.	33 per cent.
Pea coal	5 to 15 per cent.	
Slack	9 to 25 per cent.	

By recently introduced elevators, the Ohio Central Coal Company has brought down the percentage of slack to between 9 and 10 per cent. of what the miner sends out.

The extreme regularity of the coal, the excellent roof that covers it, the

fact that the mines are, in so large a part of the field, level free or hill mines, all these facts reduce the demand for skill in mining to somewhat lower terms than elsewhere. At least, mining can be done here with a smaller amount of training and experience than in many other districts.

Improvement in Electric Safety-Lamps.

The *Mining Journal* points out that in electric safety-lamps as hitherto constructed for use in mines, if the globe enclosing the filament be broken, the filament will generally retain sufficient heat to ignite carburretted hydrogen, and consequently explosion may ensue. It has been proposed to enclose an incandescent lamp within a glass casing or lantern filled with water; but in this arrangement if the glass casing be broken the water will escape, and the lamp then is practically unprotected, and therefore dangerous. It has also been proposed to fill the outside casing with water impregnated with carbonic acid gas under pressure for operating a flexible disc (or equivalent means), to which is attached a contact piece in such a manner that a pressure within the casing will cause contact to be made so as to establish the electric circuit. In this arrangement if the casing be broken the gas and liquid contained therein will escape, the interior pressure will be removed, the circuit will be immediately broken, and the lamp extinguished. In practice, however, it has been found that the breaking of the circuit in the manner described produces a sparking which would ignite explosive gases, so that such lamps have not been practicable.

The improvements proposed by Mr. T. Coad, of Finsbury, England, consist principally in preventing such sparking by constructing the contact pieces of sufficient length, and in placing over such contact pieces a covering of suitable material, such as india rubber or the like, which will closely embrace the parts so as to effectually exclude all dangerous gas from coming into contact with the sparks produced on the breaking of the electric current. And further, in order to prevent the sparking which might be produced by metallic contact, whether accidental or otherwise, he dispenses with the use of terminals by carrying the conducting lines direct from the lamp into the battery, so that when the lamp is fixed thereto the wires will be entirely enclosed and protected. In order to prevent the escape of the carbonic acid gas employed to produce the pressure within the glass casing he employs a flanged disc and a flanged ring. The outer glass casing consists of a flanged dome, the bottom of the flange of the dome resting against the upper face of the disc, and the top of the flange bearing against the under side of the flanged ring. The disc and ring are clamped together by bolts and nuts, so as to allow of securing, by means of suitable packing, a tight joint between the glass and the ring and disc, thereby effectually preventing the escape of the compressed gas.

The battery and its receptacle, the lamp, the flexible disc, and the spring for breaking contact if the lamp be broken, are all of known construction. There are contact pieces to receive a covering of suitable material, such as india rubber or the like, which will closely embrace the contact pieces; the lower contact piece is provided with a lock nut for adjusting its position with regard to the upper contact piece; there are the usual conducting wires, which he carries direct from the lamp into the battery, where they are connected direct to the poles of the battery instead of to the terminals usually fixed thereto; the wires when the lamp is fixed thereto will be thereby entirely enclosed and protected. There is a flanged disc and a flanged ring for fixing the outer glass over the lamp, the glass being filled with water impregnated with carbonic acid gas as heretofore; the outer glass is flanged, the bottom of the flange resting against the upper face of a flanged disc, and the top of the flange bearing against the under side of the flanged ring; there are bolts and nuts for clamping the disc and ring together, and the packing for securing a tight joint between the glass and the ring and disc. In a lamp of this construction, if the interior pressure be removed from the flexible disc by the casing or glass becoming broken, the disc will be forced upward by a spring, which will also carry up the contact piece, and contact will be thereby broken between the two contact pieces; the sparking produced by the breaking of the circuit in this manner will be prevented from igniting the explosive gases, as such gases will be effectually excluded by the covering over the contact pieces. Further, any sparking which might otherwise occur is obviated by dispensing with the use of terminals, and carrying the conducting wires direct to the battery. By employing the flanged disc and ring, and flanged outer glass connected together as described, the escape of the carbonic acid gas employed to produce the pressure within the glass casing is effectually prevented.

The novelties claimed are: 1. In miners' incandescent electric safety-lamps the described method of preventing the effects of sparking in the event of the breakage of the electric circuit by enclosing the contact pieces with a covering of suitable material. 2. The method of preventing sparking in miners' incandescent electric safety-lamps by carrying the conducting wires direct from the lamp into the battery, whereby they will be enclosed and protected; and—3. The described means for producing a tight joint to prevent the escape from the outer glass casing of the compressed gas employed to operate the flexible disc.

Slag Cement.

Engineering has on several occasions directed attention to the ingenious and very successful methods pursued by Mr. Frederick Ransome for the preparation of a cement from blast furnace slag and lime. In its latest "Note" on the subject our contemporary mentions a discovery, made by Mr. Charles Wood some twelve years ago, that slag run from a blast furnace in a molten condition falls into a fine granulated state, which removed one of the main objections to its utilization—the great cost attending its reduction to powder by mechanical means. One of the materials composing the Ransome cement is thus obtained ready for use, and being practically a waste product, its cost is nominal, the expense attending its application being limited to handling. By his earlier method the other material employed—chalk or lime—was ground and mixed with the slag, the combination being then calcined and again ground; from this resulted a cement possessing very high qualities both as regards quickness in setting and strength. Very recently, however, Mr. Ransome, following the same line of investigation, has improved greatly on his former simple process, and he has found that the spent lime from gas works may be employed with results as good as those obtained with lime prepared specially for the purpose. In order, however, to get rid of the sulphur with which the lime is saturated when it leaves the gas purifier, Mr. Ransome resorts to a very simple and efficacious device. He mixes a certain proportion of powdered coal or coke with the slag and lime, and when this is exposed to the heat of the calcining furnace, the action of the coal or coke converts the sulphate into a sulphide of lime, that is subsequently entirely got rid of by the introduction of a jet of steam which drives off the whole of the sulphur impurities as sulphuretted hydrogen, leaving the lime quite pure. This, however, is only one of the recent improvements to which we have referred. A highly important modification is the use of a revolving retort for the calcination of the slag and lime. It is found that after the materials have been thoroughly burnt in this manner, they remain in the same fine state of subdivision as when they were placed in the retort, and on being discharged will pass through a sieve of 80 meshes to the inch. The costly process of grinding, which is unavoidable in the ordinary method of manufacture, is thus avoided, while the cement is said to lose none of its useful characteristics in this novel process. Of course this system is equally applicable where fresh lime is employed, instead of the waste material from gas works, only in such a case it is unnecessary to add the powdered coke, or to apply the steam jet. We have referred in general terms to the strength of the cement produced by this method; the following table of comparative tests made with samples of Portland and Ransome cement show clearly the remarkable qualities possessed by the latter; the samples in each case were 1½ inch square, giving a sectional area of 2¼ square inch.

Age of Sample.	Portland Cement. Breaking Load. lbs.	Ransome Cement. Breaking Load. lbs.
2 days	510	740
3 "	698	870
7 "	818	1,170
12 "	...	1,300
15 "	...	1,330
21 "	...	1,440
28 "	936	....
7 years	1,327	....

The foregoing figures speak for themselves, and indicate clearly that the Ransome cement possesses striking advantages over Portland, especially as it reaches a strength within a few days which is higher than the Portland after seven years. Very important advantages are also found in the simplicity of manufacture, and the suppression of the final process of the cement manufacturer—that of grinding. The plant used is therefore simpler and involves much less expense in maintenance and labor for the production of a given quantity of cement than is required in the ordinary mode of manufacture. When, in addition to this, it is remembered that waste materials are employed, it will be easily understood why the slag cement can be made for half the cost of Portland, and the commercial importance of Mr. Ransome's process will be readily appreciated.

Dividends Paid by San Francisco (Cal.) Gas and Electric Light Companies in 1884.

An occasional correspondent sends us a statement concerning the number and amount of dividends paid by gas and electric light companies of San Francisco during the year ended December 31, 1884. The figures were first published in the San Francisco *Bulletin*, and are interesting, since they go to show how "opposition" plants deplete the pocketbooks of investors. It will also be noted that the California Electric Light Company has proved very far from being the "bonanza" which its "locators" fondly imagined, and loudly declared, they had "struck." The details are as follows:

	Dividends.	Amount.
California Electric Light	6	$18,000
Central Gas (Sacramento)	4	42,500
Central Gas Light	2	40,000
Gas Consumers' Association	4	5,250
Oakland Gas Light and Heat	12	72,000
San Francisco Gas Light	2	150,000
Total, 1884		$327,750
Total, 1883		387,000

The California Electric Light Company paid 6 dividends of 6c. per share each in the first six months of the year, since when some heavy expenses have been incurred in the erection of masts for lighting certain portions of the city. The Capital Gas Company paid a quarterly dividend of $1.25 per share in January, 1884, and three quarterly dividends of $1 per share in April, July, and October. As the par value of the shares in this company is $50, the dividends for the last three quarters of the year were at the rate of 8 per cent. per annum. The property of the Central Gas Light Company is leased to a Philadelphia corporation for 20 years. This corporation is understood to guarantee to the stockholders of the Central Company 4 per cent. per annum on the capital. The first quarterly dividend under this arrangement was paid in August, and the second in November. The Gas Consumers' Association is an organization which has a patent for the regulation of the pressure of gas at the meter, whereby the light is made steadier and the consumption greatly lessened. The expense of this attachment is said to be less than one-half of the saving in gas bills. This Association pays its dividends quarterly, the first three having been at the rate of 25c. per share and the last at the rate of 30c. per share. The Oakland Gas Light Company was re-incorporated a few months ago under the name of the Oakland Gas, Light and Heat Company, with the same capital, shares, and officers. The object of the change was to enlarge the sphere of business, so as to take in the manufacture and sale of electric light, power, and heat in connection with gas. The company pays 20c. per share monthly on a capital of $3,000,000, in 30,000 shares. The San Francisco Gas Light Company paid a dividend of 50c. per share last January, and another of $1 per share last May. This is 1½ per cent. for the year on the capital. In 1883 the company paid $280,000 in dividends, or at the rate of 2.80 per cent. on the capital. The past two years have been the most unprofitable in the history of the company. The Central Gas Light Company entered the field in competition three years ago, and the cutting of rates which followed, while it has been of advantage to consumers, has depleted profits, and has had a very depressing effect on the value of shares. The price of shares in the San Francisco Gas Light Company has been reduced from 95 and upward to 48, but now 58. The company used to pay dividends monthly with great regularity, first at 6 per cent. per annum, and afterward at 9 per cent. In January, 1880, these were reduced to 8 per cent.; in March, 1880, they were reduced to 7 per cent.; and in August, 1881, they were suspended, so that the dividends for 1881 were only 4.08 per cent. In 1882 the company paid $400,000 in four dividends, or at the rate of 4 per cent. For the past two years the dividends have been at the rate of 2.15 per cent. per annum. During a portion of this time the price of gas was $1.50; last October the price was raised to $2.25, both companies agreeing to that basis. An attempt was made to have this rate ratified by the Supervisors, but the Mayor vetoed the bill. Still, the company is collecting its bills on that basis.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

The Electric Lighting of Hell Gate Channel.—The electric promoters seem to believe that the tower lights placed over that seething cauldron so aptly named Hell Gate are thoroughly competent to fill the task allotted by their erecters—the ample illumination of that dangerous channel connecting Long Island Sound with New York harbor proper. At least we must judge that such is the idea and belief of their designers, and the entire set of electrical followers as well; for on every available opportunity are the praises of Hell Gate's lights sung to the usual "meter;" and it may safely be asserted that the "meter" lacks not a plentiful sprinkling of staccato "signs." If these praises were but solely directed to the beauty of the spectacle presented by the "arcs" on clear nights, why, all of them would be true; but the trouble is, not only is beauty alone claimed for them—effectiveness and complete adaptability are also vouched for as having been attained. *Engineering* in a recent issue rather unwittingly proves why these latter "claims" should have no foundation, and does it thus: "The approach to New York harbor from Long Island Sound on the northeast, called Hell Gate, is through a narrow, tortuous channel, through which navigation is rendered difficult by reason of the rapid currents which vary with the tide. This channel has been illuminated by a group of nine 6,000-candle power Brush electric lights, which are placed at an elevation of 250 feet, and are visible at a distance of 40 miles." All of this is true enough in the main; but we fail to perceive what striking advantage is to accrue to the mariner who desires to tread the devious ways of that small but celebrated strait. It may comfort him somewhat (although we doubt it) to have positive knowledge that when a certain point in his voyage is reached he is just 40 miles away from the perilous spot; but it does seem as though he would not need the assistance of the "arcs" to tell him so. What he might desire would probably be the assurance when the maelstrom was entered, the "arcs" were capable of shining on his pathway, and thus alleviate the dangers of the pass. No matter what the electrical promoters assert in regard to the effectiveness of the Hell Gate lighting, it is to the testimony of those for whose ostensible benefit the expense was incurred that the greatest weight should be attached. The Sound navigators are constantly complaining of the lighting system, and on a recent occasion one of the best pilots in the Sound service (Captain J. F. Peck, of the steamboat *Northam*), while describing a rather dangerous trip that he had successfully accomplished, freed his mind, concerning the Brush lights, in the following pungent style: "During thick weather we are obliged to feel our way carefully down the harbor * * * * Let me say, just here, as to lights, that the new-fangled electric light at the 'Gate' is *worse than useless* to our Sound navigators. One *can* see the light; but it is so dazzling that *nothing else* can be seen. It makes the darkness visible around it, and obscures whatever that darkness may contain." While we are obliged to confess that Capt. Peck's language may not be as limpid as some might desire, it is nevertheless clear enough to bring conviction to most minds that he does not look upon the Hell Gate towers as conducing very greatly towards the safety of the Sound pilot.

Personal.—Mr. R. D. Wirt, who for the past three years has succeeded most thoroughly in managing the duties connected with the position of Superintendent of the Independence (Mo.) Gas Light and Coke Company, has taken upon his shoulders the additional load of caring for the Independence water works in a managerial capacity.

Suffocated by Gas.—A man named T. C. Schuren, a temporary guest at the Commercial House, Youngstown, Ohio, was suffocated through the inhalation of illuminating gas which escaped into an apartment of the above-named hotel, on the evening of January 27th. Deceased, prior to retiring, was somewhat unsteady from the effect of a too free indulgence in liquor. It is supposed that it was a case of turning the gas off and then on again. His home was at Cleveland, Ohio, and he was pretty well off as to this world's goods.

For Sale at Half Price.—The stockholders of the Electric Lighting Company, at Dubuque, Iowa, having been on the "ragged edge" of financial weakness for many a weary month, at last decided to wind up the concern, and so have gone into a voluntary liquidation. This brave band of enthusiasts started in to make grass grow thick and fast around the coal sheds, etc., of the Dubuque Gas Works; but, as we all know, "the best laid plans of mice and men gang aft aglee," hence this short obituary mention regarding the blighted hopes and sad prospects of the Dubuque electrical promoters. Matters having gone on from bad to worse with them, it was determined at the last annual meeting to discontinue the business and offer the plant for sale at "half price." The reports show that the company had been losing money at the rate of at least $1,500 per annum. Gone and forgotten.

Great Decrease in the English Coal Mining Death Rate.—The official figures showing total number of deaths (during 1884) resulting from explosions in English coal mines are very favorable when compared with those of previous years. In fact the tables prove that the past year has been freer from these occurrences than any of its predecessors making up the last fifth of a century. The yearly tables dating back from 1865 are as follows:

Year.	No. lives lost.	Year.	No. lives lost.
1865	168	1875	288
1866	651	1876	95
1867	286	1877	345
1868	154	1878	586
1869	257	1879	184
1870	185	1880	499
1871	269	1881	116
1872	154	1882	250
1873	100	1883	134
1874	166	1884	52

This speaks well for the management of English colliery operations during the twelvemonth, and bids us hope that the time is not far distant when the occupation of the coal miner will be removed from the list embracing the names of those considered extra hazardous.

Boring for Natural Gas at Ironton, Ohio.—The proprietors of the Belfort Iron Works Company, of Ironton, Ohio, have for some time past

been impressed with the idea that it would be worth while to make an attempt to bore for natural gas wherewith to secure cheap fuel for their furnaces. They started the drills agoing in January, and when the bore-hole had penetrated to a depth of 100 feet it encountered a weak vein. The gas flow, when ignited at well mouth, had only sufficient pressure to sustain a flame of about nine feet in height, and this volume being entirely insufficient for the needs of the works, boring was once more proceeded with. On February 1st the drills were down to a depth of 500 feet, with no new developments. The Belfort iron works are located quite close to the plant of the Ironton Gas Company, and as a consequence the gas folks are viewing the boring progress with a very pardonable feeling of curiosity.

Its True Function.—One of our exchanges says that Dr. W. B. Richardson has been carefully studying the subject of how best to produce painless death among the lower animals. As a result of his inquiries the Doctor claims to have succeeded in securing enthanasia for them, which he proposes to effect in the following manner. The animals to be destroyed are placed in a chamber into which is forced a current of carbonic oxide, passing, at 80° Fah., over a mixture of chloroform and carbon bisulphide. Extinction of life is soon effected in the chamber by the lethal nature of its atmosphere so brought about. The attention of city and town authorities, within whose limits water gas concerns are operated, should be called to Dr. Richardson's proposition.

One Way for Small Gas Companies to Avoid Trouble.—The following practice pursued by Mr. J. C. Pratt, President of the Jamaica Plain (Mass.) Gas Light Company, is not put forth as containing anything novel, nor does it follow that the very largest company in the country could not fail of finding sufficient profit in carrying out a similar policy, because we offer it to the consideration of managers of the less extensive works. Indeed it is a trifle humiliating to be obliged to refer to the thing at all, for the system is so plain and matter-of-fact that one would naturally suppose *every* company had instituted and carried it out long ago, and had done so merely as a matter of absolute necessity. Speaking of large companies, before going any further at this point into the practice of President Pratt, we cannot forbear mentioning a circumstance that happened in New York city shortly after the Consolidated Gas Company became a fixed fact. In one of the up-town districts a decision was arrived at that a certain section of the territory formerly supplied by one plant should be supplied from the mains of another—the change being made in order that distribution might thereby be facilitated. In short, it was a change from coal to water gas—the water gas plant, owing to its location, being much better calculated to furnish the supply in the particular section. The consumers were not previously notified of the arrangement, and the burners that had been doing duty in regulating the consumption of the coal gas were left undisturbed, and the water gas was passed through them. The consequences may easily be imagined; the storekeepers and householders complained that the gas was so bad as to be really worse than useless. There was no light, but there was plenty of smoke, etc. Of course, in a week or two all this was remedied through a substitution of proper burners; but it would have been much more to the credit of the business tact of those in charge of that particular branch of the Consolidated Company if the consumers had been told what they should have been informed of before the one sort of gas was cut off and the other turned on.

Mr. Pratt has simply gone to the slight trouble of getting up a small note-sized circular, printed on plain white paper, a copy of which he has had mailed to each one of his company's consumers. He commences by cautioning people against purchasing burners from irresponsible parties—peddlers, and others of that stripe. This he does because he has learned that "traveling agents" are abroad who have been visiting the householders and offering these latter inducements to purchase a superior gas saving burner, placing the consumption of same at 3 feet per hour, etc. The "agents" succeeded in getting many of the Jamaica Plain people to invest in the article, and some of the "samples" tested by Mr. Pratt have been shown to consume 6 feet per hour. Of course, the agent does not experience much trouble in making a sale after "plainly showing what a great advantage is obtainable." With his handy pliers he takes off a 3-feet burner from a fixture, and calmly replaces it with one burning double that quantity, and then inveighs against the "rascality of the gas man." Seeing is believing, but reading is the printed truth. The consumer sees and believes, buys a dozen or two burners and pays for them. Off goes the agent; at the end of the month in comes the gas bill. Perhaps reading is convincing then; convincing of what? That the agent was a fraud? Oh, no! That the gas company's meter is a liar? Oh, yes! This is the state of affairs that Mr. Pratt's practice prevents. He warns the consumer against such traps for the unwary, and then informs him that he may purchase at the office of the gas company, *at cost*, the best, most reliable, and economic burners that are manufactured. The Jamaica Plain Company makes no charge for attaching the burners, and gives a guarantee that each burner sold will not burn more than its rated consumption. Every medium and small sized company suffers from the incursions of the "traveling agent," and when that worthy is "carrying a select line of excellent gas burners in stock," it is well worth the while of the "gas man" of the town to make the "agent's sales" as light as possible through having instructed the gas consumer that the proper place for him to obtain a good and reliable gas burner is at the office of the gas company.

Cheaper Gas for New Rochelle, N. Y.—Mr. C. C. Van Benschoten, a gentleman who has been quietly working along for many years in directing the affairs of the New Rochelle (N. Y.) Gas Light Company, has never made much noise amongst the fraternity of the Empire State, but he has been and is a careful observer of events as they transpire in the history of our common calling. New Rochelle is a small place, and presumably outside the designs of the wreckers, as the daily consumption of gas there is under 10,000 cubic feet; so that "the man in charge of the helm" at that point need have but slight fear that the aforementioned gentry would strive to "make port" in his locality. In these matters, though, there are other things to be considered besides the warding off of opposition; and of these other things increased output—not to mention a desire or wish to benefit one's fellow-townsmen—should furnish sufficient incentive to a lowering of selling rates. If Mr. Van Benschoten can see his way clear to the course below mentioned, we are certain that not a shadow of excuse is left for any other manager in the State of New York for charging a higher rate. We are glad to give place to Mr. Van B.'s letter, and hope that a perusal of it will set some of the managers of small works to thinking. The rate before reduction was $3.50 per thousand.

"New Rochelle, N. Y., Jan. 30, 1885.

"To the Editor Journal:—The increased consumption of illuminating gas manufactured by us during the year just closed has given us encouragement; and as an incentive to a still greater increase in our business we have decided to reduce the price of gas on and after Feb. 1, 1885, to $2.50 per thousand cubic feet to all consumers who settle their bills by the 10th of each month; 10 per cent. additional will be charged on all bills remaining unpaid after that date. In relation to this reduction we are glad to state that it is voluntary on our part, and not because of threatened opposition of any kind; our motive is to deal squarely with our patrons. The village grant under which we are working gives us the privilege of charging $3.50 net per thousand until we reach the daily output of 50,000 cubic feet. We have reached a consumption of only about one-fifth of that amount, and now propose to sell gas of equal illuminating power at $2.50; and we are further pleased to be enabled to state that we know of no other gas works of the same capacity selling illuminating gas at a lower figure."

It seems unnecessary to add that Mr. Van Benschoten is a firm believer in coal gas.

Broken Panes.—It is said that about $5,000 worth of street gas lantern panes were broken by the stone-throwing and bean-shooting urchin of Philadelphia, Pa., during 1884. Pretty "paneful" expense, that.

A Puzzled Saloonkeeper.—A saloonkeeper at Detroit, Mich., has had some experience with electricity, which he describes as "shocking." He stands his liquor glasses upon a copper tray, underneath which run a gas pipe and an electric lighting wire. The insulation of the latter became defective, and contact with the tray was made. Our German host "reached" for a glass (tray and glasses were generally in a dripping state) while things were in "contact;" hence the shock. The wire is carefully looked after now.

Proposing to Make Another Reduction.—The way matters are now shaping, it looks as though the Gas Trust at Philadelphia, Pa., see their road clear toward bringing the price of gas down to $1.50 per thousand from date of April 1, 1885.

Some Thought it was Dynamite.—At about 9 A.M. on the morning of Feb. 4 the residents of the city of Galena, Ill., were startled out of their wonted quiet by the echoes of a violent explosion. The source of the uproar was speedily traced to a cistern sunk in Bench street, at a point directly in front of the First Presbyterian Church. It appears that the cistern had been dry for some time back, and the iron top serving as a cover had been frozen fast in the receiving socket. On the morning in question the fire department laborers had orders to fill the cistern with water, and the cover was accordingly pried open. One of the men engaged on the job thought he smelled gas; and his nose not having a sufficiently keen scent, he brought the inevitable match into play. He was right—"there was gas around;" and the lighted match found it at the "first try." The match igniter recovered his senses in about half an hour; but his fellow-workmen decided that the cistern would not "hold water" for quite a while. A main belonging to the Galena Gas Company had started a joint close to the cistern wall; the gas found its way into the convenient receptacle afforded; the frost kept the cover sealed tightly; and the workman and his match are responsible for

causing the English residents of Galena to think that dynamiters were "up and doing."

Meter-Making Hands on Strike.—On January 29th last some of the hands employed in the Goodwin Gas Stove and Meter Company's factory, at Philadelphia., Pa , undertook to tell Mr. Goodwin that he was not sufficiently well versed in running his own establisment; at least one would infer that from the action taken. Mr. Goodwin has always enjoyed (and very justly so) the reputation of being liberal with his workmen, and he kept paying top rates for labor long after the time was reached when justice to himself demanded that a reduction should be made. On the date above mentioned the Goodwin Company gave notice that certain piece-work hands would be required to submit to an average decrease of 12½ per cent. in their pay. This they refused to accede to, and the whole posse of them left work in a body—those to whom the decreased rate applied along with those not affected at all making common cause of the affair, presumably at the dictation of a body calling themselves "Knights of Labor." Mr. Goodwin has since refused to treat with representatives from that body who are trying to make a settlement of the strike, and will maintain his position. According to our information, 40 hands left the shop without the slightest sign of warning to their employers; and of this number 23 had no earthly excuse for their cowardly and miserable course. If the "Knights." think they can coerce Brother Goodwin they make a mistake in their estimate of him.

Their Pledges were Kept.—When Mr. Higgins and his associates were engaged in showing the city authorities at Richmond, Va., that the time had arrived when the gas plant should be put in proper condition, so that the consumers might obtain the needed supply at a reduced expense, they were obliged to pledge themselves, if the sought-for improvements were effected, that under the new condition of things the cost of gas in the holder should not be over 60 cents per thousand cubic feet. To show that this pledge was kept and practically carried out, we submit the following tabulated statement:

Statement Showing Net Profit of Richmond (Va.) City Gas Works for Year Ending Dec. 31, 1884.

Cash receipts for gas sold		$190,250 25
" " coke sold		18,295 21
" " meter connections		1,580 24
Delinquent bills		958 40
28,772,103 cubic feet gas sold city, at $1 per M		28,772 10
19,987½ bushels coke to City Missions, at 6 cents		1,199 25
Inventory, Dec. 31, 1884		21,111 04
		$262,166 49
Less Payroll	$60,800 00	
Coal	50,897 97	
Expenses	8,118 67	
Extensions	8,519 71	
Inventory, Jan. 1, 1884	23,354 48	
		151,690 83
Net profit		$110,475 66

Cost of gas per 1,000 cubic feet in holder, 58.06 cents; number of consumers, January, 1885, 3,822; cash receipts, January, 1885, $26,551.04. Number consumers, January, 1884, 3,754; cash receipts, January, 1884, $24,272.95. Verily, the city authorities, and the people as well, will have to concede that Mr. Higgins knew what he was talking about.

A Novel Point on which an Application for an Injunction is Based.—A decidedly novel point has been advanced by an applicant before a Pennsylvania court as a reason why an injunction should issue. On Thursday, Feb. 5th, a man named Moritz Wolff, residing on Fifth street, McKeesport, Pa., made application for an injunction restraining the National Tube Works Company from laying a pipe, under the roadway in front of his dwelling, destined to act as a conduit for natural gas. His affidavit asserted that the line was being laid from Murraysville to McKeesport; and was for the sole use of defendant. As the main was being laid in midwinter, the period most favorable for the contraction of iron pipe, plaintiff claimed that summer heat would inevitably cause expansion, and consequent opening of the joints. Defendants deny the allegation as to such danger. They claim the line to be a model one, put down in accordance with every precaution, and fitted with the best known joints. Defendant admits that straight lines of pipe would possibly be open to danger, but claims that as the line in question includes a number of bends, these curves take up and provide at one and the same time for expansion and contraction. Judge Ewing hesitated about stopping the work, but appeared to attach due weight to plaintiff's claim, as was perfectly natural for him to do, remembering the number and violence of the natural gas explosions that have agitated Pittsburg and its vicinity on recent dates.

Another case similar to the above, and against the same defendants, was to be brought before the attention of the court on the following day (6th), and as neither plaintiff nor defendant in Wolff's case had presented sufficient affidavits, Judge Ewing continued the argument over until Saturday (7th), with the understanding, though, that pipe laying would be suspended during intervening period. We have received no later advices than those of morning of 6th, and would ask that our friends at Pittsburg be kind enough to post us as to the decision arrived at.

Brooklyn (N. Y.) Street Lighting.—The "reform" board of aldermen in the city of Brooklyn are repeating their tactics of former years in regard to delaying the awarding of contracts for lighting the city's streets in 1885. The whole business looks as though somebody was waiting for a "dividend." It appears, also, that an item was inserted in the yearly tax levy appropriating $15,000 to be expended in maintaining electric lights; and the two electric companies propose to divide that amount between them, they agreeing to furnish lights at the price of $255 each per annum. The "reform" member of the board, rejoicing in the name of McCarty, gives it as his opinion that one-half of the total amount ($340,000) appropriated for the street lighting of 1885 should be expended on "arc" lamps. The proposition is so extremely verdant (unless Mr. McCarty is largely interested in electric lighting stock) that grass would appear very much blanched when placed in comparison with it. Brooklyn city, owing to its peculiar manner of growth, being spread over an immense area, and the fact that it is essentially a place of residence (it is perfectly safe to assume that nine-tenths of the population are in their beds by 11 P.M.), offers but little encouragement to electric lighting speculators. At the stated price of $255 per lamp, it would certainly mean an expenditure of over one-half million of dollars to properly light one-half the city with the "arcs"—although, were one to take the estimated displacement vouched for by the Brooklyn electricians (one arc is set down as taking the place of 12 gas lamps), the cost would be much less. If the displacement figure given were divided by three, the result would be about right. Perhaps Mr. McCarty only suggested the substitution of electricity for gas, on such a wholesale basis, in a jocular way; or perhaps he threw the hint out as a sort of reminder that the gas men ought to "come to terms" with a little greater alacrity than they are at present displaying. By way of conclusion, it may be here added that Brooklyn has long enjoyed the reputation of being (as to its streets) one of the best lighted cities in the United States.

RECENT PATENTS.

The following list of patents relating to improvements in gas apparatus, etc., granted by the United States Patent Office since January 1, 1885, is specially reported for the Journal by Franklin H. Hough, Solicitor of American and Foreign Patents, 925 F Street, N. W., Washington, D. C.

Issue of Jan. 6, 1885.

310,487. Gas, apparatus for the manufacture of. A. L. Allen, Poughkeepsie, N. Y.
310,240. Gas regulator. T. Angell, Brooklyn, N. Y.

Issue of Jan. 13, 1885.

310,616. Gas and other machines, cooling attachment for. J. Ring, St. Louis, Mo.
310,841. Gas conducting mains, preventing leakage from. M. Moeser, Allegheny, Pa.
310,745. Gas furnace. W. Swindell, Allegheny, Pa.
310,580. Gas governor, automatic. M. O. Gorman, Jersey City, N. J.
310,744. Gas retort. A. C. Swain, Chico, Cal.
310,605. Gas valve, automatic. I. B. Millner, Bay City, Mich.

Issue of Jan. 20, 1885.

311,131. Gas and electric light fixture combined. P. H. Klein, N. Y. City.
310,945. Gas burner. W. M. Jackson, Providence, R. I.
311,161. Gas generator. F. Clauss, Elizabeth, N. J.
311,124. Gas, process of and apparatus for manufacturing. J. Hanlon, New York, N. Y.

Issue of Jan. 27, 1885.

311,403. Gas, furnace for generating illuminating. S. I. Anthony, New York, N. Y.
311,441. Gas generator. L. Mond, Winnington Hall, County of Chester, England.
311,214. Gas motor. G. M. Ward, Newark, N. J.

Issue of Feb. 3, 1885.

311,483. Gas, apparatus for manufacturing. A. O. Granger and J. H. Collins, Philadelphia, Pa.
311,484. Gas generating apparatus. A. O. Granger, Philadelphia, Pa.
311,493. Gas generating apparatus. I. James, Mattoon, Ill.
311,840. Gas lighting apparatus. F. Lane, Boston, Mass.
311,858. Gas Machine. W. C. Strong, Redfield, Me.
311,585. Gas works, hydraulic main for. C. W. Isbell, New York, N. Y.

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MONDAY, FEBRUARY 16, 1885.

The Market for Gas Securities.

The city gas share market during the fortnight has been dull and steady, although Equitable exhibited considerable strength toward the close. Consolidated seems inclined to go lower, and why it should follow the downward course is rather enigmatical to those on the inside. Transactions have taken place at a fraction below 80, and the croakers are predicting 75 as a figure sure to be seen in future quotations. This view we do not incline to, and still adhere to the opinion that Consolidated is a purchase. Equitable moved up rather sharply, and is strongly held at asking price of 97. The "gas reformers" are still wagging their tongues and shaking their heads over the enormities practiced by the gas makers of New York city, and the records of their meetings present a most amusing collection of absurdities. The initial session developed that progressive amateur, Bottsford, and one of the later seances resuscitated the venerable figure of Mr. James Crutchett, C.E., who expatiated upon the merits and economies of "Steam Carbon Gas." The patriarchal enthusiast informed the "reformers" that "good illuminating gas could be sold at a profit at the charge of 30 cents per thousand cubic feet; and heating gas, at 15 cents per thousand, had millions in it." That is the sort of "pap" which is being supplied to Messrs. Sherwood, *et al.*

Brooklyn stocks are dull and steady; the only changes worth noting have taken place in Brooklyn and Williamsburgh Companies' stocks—the former is higher by two points, the latter showing a decline similar to advance in former. On Feb. 9th the Supreme Court of Missouri affirmed the judgment rendered by Court of Appeals on a former occasion in case of St. Louis Gas Light Company against city of St. Louis. The decision awards the gas company judgment for $957,346 for gas furnished city from 1865 to 1873. This sum includes interest on deferred payments. Peoples, of Jersey City, has fallen about 20 points.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks (with A. E. Scott & Co.,)

72 Broadway, New York City.

Feb. 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Central	$440,000	50	60	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	95	97
" Bonds	1,000,000	—	102½	103½
Harlem	2,000,000	50	110	113
" Bonds	170,000		—	—
Manhattan	4,000,000	50	240	250
Metropolitan	2,500,000	100	210	220
" Bonds	658,000	—	110	112
Mutual	3,500,000	100	120	122
" Bonds	1,500,000	1000	104	106
Municipal	3,000,000	100	190	200
" Bonds	750,000		107	110
New York	4,000,000	100	145	150
Northern	125,000	50	—	80
" Scrip	108,000			
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	129	131
Citizens	1,200,000	20	84	86
" S. F. Bonds	320,000	1000	106	110
Fulton Municipal	3,000,000	100	148	150
" Bonds	300,000		104	108
Peoples	1,000,000	10	77	80
" Bonds	290,000	—	105	110
" "	250,000	—	90	95
Metropolitan	1,000,000	100	96	—
Nassau	1,000,000	25	119	—
" Ctfs	700,000	1000	92	94
Williamsburgh	1,000,000	50	132	135
" Bonds	1,000,000	—	106	108
Richmond Co., S. I.	300,000	50	64	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	80	85
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	103	115
" " Bonds	124,000	—	105	110
Chicago Gas Co., Ills	5,000,0000	25	125	—
Peoples G. L. & C. Co., Chicago, Ills			8	12
Cincinnati G. & C. Co.			180	182
Consolidated, Balt.	6,000,000		81½	82
" Bonds	3,600,000		110	111½
Central, S. F., Cal.			—	58
Capital, Sacramento, Cal.			56	—
Hartford, Conn.	750,000	25	123	129
Jersey City	750,000	20	124	128
Laclede, St. Louis, Mo.	1,600,000	100	88	—
Louisville, Ky.	1,500,000	50	95	100
Montreal, Canada	2,000,000	100	181	182½
New Haven, Conn.		25	166	170
Oakland, Cal.			29	30
Peoples, Jersey City			45	50
" " Bonds			—	—
Paterson, N. J.		25	90	—
Rochester, N. Y.		50	75	80
Washington, D. C.	2,000,000	20	190	195
Wilmington, Del.		50	188	—
Yonkers		50	90	92
St. Louis, Missouri	600,000	50	—	—
San Francisco Gas Co. San Francisco, Cal.			59½	60

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 106
Wm. Henry White, New York City ... 100

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd, New York City ... 107
T. F. Rowland, Greenpoint, L. I. ... 107
Delly & Fowler, Phila., Pa. ... 107
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 107
Stacey Mfg. Co., Cincinnati, Ohio ... 107
Bartlett, Hayward & Co., Baltimore, Md. ... 107
Morris, Tasker & Co., Limited, Phila., Pa. ... 106
Davis & Farnum Mfg Co., Waltham, Mass. ... 74
Tanner & Delaney Engine Co, Richmond, Va. ... 100
R. D. Wood & Co., Phila., Pa. ... 100

GAS AND WATER PIPES.

A. H. McNeal, Burlington, N. J. ... 106
Gloucester Iron Works, Phila., Pa. ... 106
Warren Foundry and Machine Co., Phillipsburgh, N. J. ... 106
Meilert Foundry and Machine Co., Reading, Pa. ... 106
Cincinnati and Newport Iron and Pipe Co., Newport, Ky. ... 106

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 105

REGENERATOR FURNACES.

Charles F. Dieterich, Baltimore, Md ... 46

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J. ... 104
B. Kreischer & Sons, New York City ... 104
Adam Weber, New York City ... 104
Laclede Fire Brick Works, St. Louis, Mo. ... 104
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y. ... 104
Borgner & O'Brien, Phila., Pa. ... 104
William Gardner & Son, Pittsburgh, Pa. ... 104
Henry Maurer, New York City ... 104
Chicago Retort and Fire Brick Works, Chicago, Ills. ... 104
Baltimore Retort and Fire Brick Co., Baltimore, Md. ... 104
Standard Gas Retort and Fire Brick Co., Ironton, Ohio ... 104
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo. ... 104
Cincinnati Gas Retort & Fire Brick Co., Cincinnati, O. ... 104

GAS STOVES.

American Meter Co., New York and Philadelphia ... 19
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa. ... 84

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 106
McNab & Harlin Mf'g Co., New York City ... 102
John McLean, New York City ... 100

GAS METERS.

Harris, Griffin & Co., Phila., Pa. ... 110
American Meter Co., New York and Philadelphia ... 111
The Goodwin Gas Stove and Meter Co., Phila. Pa. ... 111
Helme & McIlhenny, Phila., Pa. ... 111
Maryland Meter and Mfg. Co., Baltimore, Md. ... 110
D. McDonald & Co. Albany, N. Y. ... 111
Nathaniel Tufts, Boston, Mass. ... 110

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind. ... 101
Smith & Sayre Manufacturing Co., New York City. ... 108
Wilbraham Bros., Philadelphia, Pa. ... 108

GAS COALS.

Penn Gas Coal Co., Phila., Pa. ... 109
Perkins & Co., New York City ... 108
Newburgh Orrel Coal Co., Baltimore Md ... 109
Despard Coal Co., Baltimore, Md. ... 109
Chesapeake and Ohio R.R. Coal Agency, N. Y. City ... 109
Westmoreland Coal Company, Phila., Pa. ... 109

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa. ... 112
Continental Gas Engine Co. New York City. ... 102

GAS LAMPS.

Siemens Regenerative Gas Lamp Co., Philadelphia, Pa. ... 105
G. Shepard Page, New York City ... 109

GAS KILNS AND OVENS.

Thompson Gas Kiln and Oven Co., New York City ... 100

PURIFIER SCREENS.

John Calot, Lawrence, Mass. ... 102

STREET LAMPS.

J. G. Miner, Morrisania, New York City ... 101
Bartlett Street Lamp Mf'g Co., New York City ... 101

BURNERS.

G. Gefroter, Phila., Pa. ... 106
Walter Anderson, New York City ... 106

PURIFYING MATERIAL.

Connelly & Co., New York City ... 101

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City ... 74

PIPE COVERINGS.

Chalmers-Spence Company, N. Y. City ... 100

GAS FIXTURES.

Mitchell, Vance & Co., New York City ... 101

STEAM ENGINES.

Westinghouse Machine Co., Pittsburgh, Pa. ... 109

STEAM PUMPS.

A. S. Cameron Steam Pump Works, N Y. City ... 101

PIPE CUTTING MACHINE.

Pancoast & Maule, Philadelphia, Pa. ... 101

HYDRAULIC ELEVATOR.

Lane & Bodley Company, Cincinnati, Ohio ... 101

SHAFTING, PULLEYS, ETC.

A. & F. Brown, New York City ... 102

HYDRAULIC MAIN.

A. E. Boardman, Macon, Ga. ... 100

BOOKS.

The Chemist's Assistant ... 100
King's Treatise ... 102
Scientific Books ... 110
Fodell's Book-Keeping ... 101
Management of Small Gas Works ... 102
Newbigging's Gas Manager's Handbook ... 101

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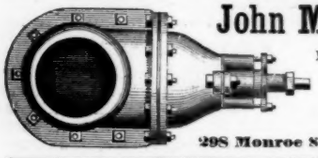

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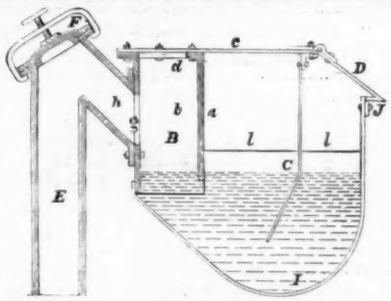

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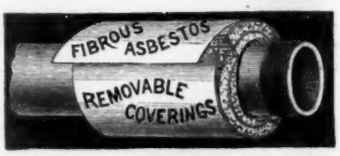

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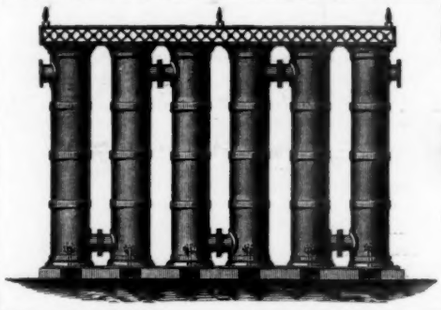

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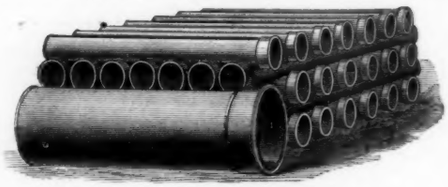

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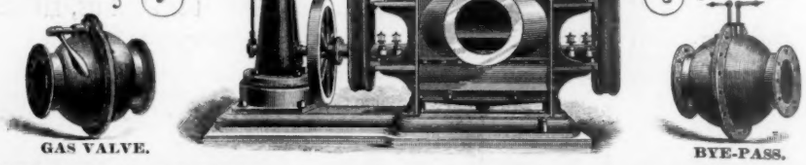

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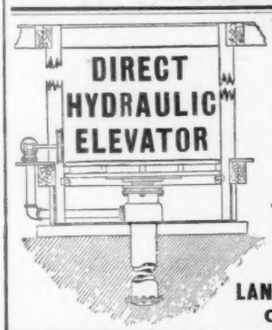

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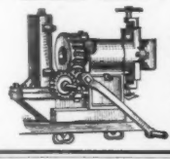

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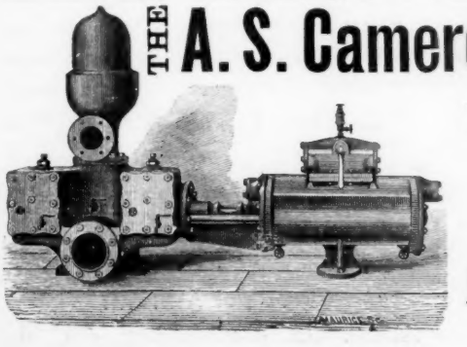

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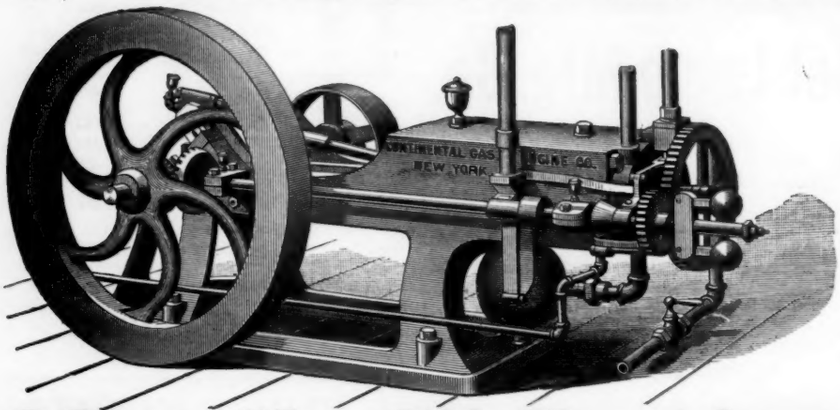

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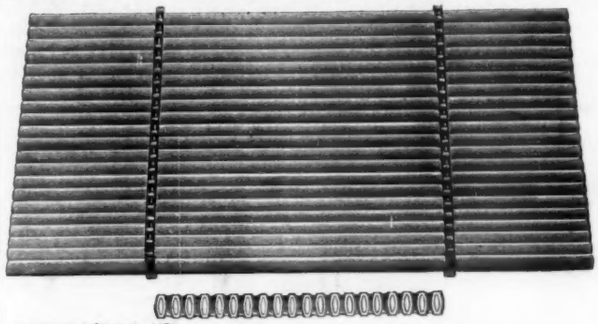

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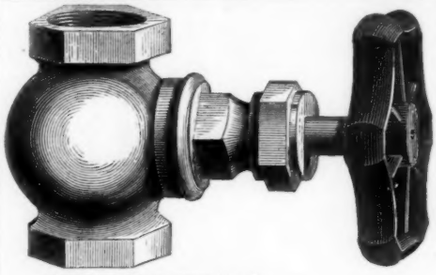

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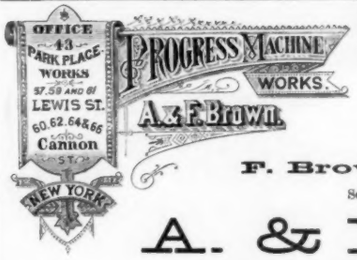

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Standard Fire Bricks.

CINCINNATI
Gas Retort & Fire Brick Co.,
(ESTABLISHED 1872.)
CINCINNATI, OHIO.
Manufacturers of Gas Retorts, Retort Settings, Fire Brick, Tiles, Etc.

OAKHILL
GAS RETORT & FIRE BRICK
COMPANY.
PARKER, RUSSELL & CO.
City Office, 45th & Clark Sts,
ST. LOUIS, MO.
Our immense establishment is now employed almost entirely in the manufacture of
MATERIALS FOR GAS COMPANIES.
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. Our customers are in almost every State of the Union, to all of whom we refer.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Sup
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.
Connection with the City by Telephone.
Clay Retorts, Blocks & Tiles,
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS.
Sole Agents for New England States

Siemens's Regenerative Gas Burners,

For Lighting and Ventilating.

THE CHEAPEST, PUREST, AND MOST BRILLIANT OF ALL GAS LIGHTS.

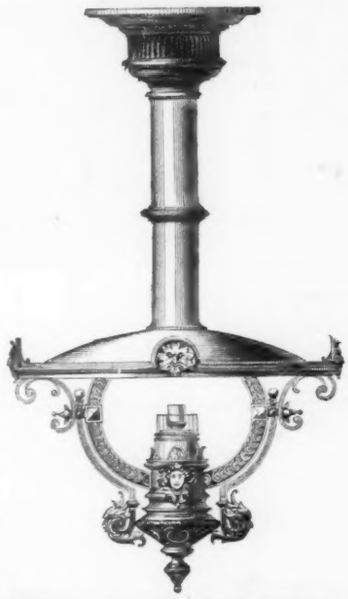
Superior to the Electric Light in Economy, Beauty, & Steadiness.

SPECIALLY ADAPTED FOR LIGHTING HALLS, FACTORIES, OPEN SPACES, ETC.

Numerous Tests made by various Gas Companies in the United States show an Efficiency of Ten Candle Power per Cubic Foot of Gas.

General Agents:

SIEMENS LIGHTING CO., 347 West Main St., Louisville, Ky.
MEYER, MARSHALL & CO., 528 California St., San Francisco.
DENNEHY, WOLF & O'BRIEN, 85 & 87 Dearborn St. Chicago, Ill.
WILCOX & McGEARY, - No. 11 Bissel Block, Pittsburgh, Pa.
T. T. RAMSDELL & CO., - 20 Swan Street, Buffalo, N. Y.
SIEMENS GAS ILLUMINATING CO., Room 6, No. 157 Broadway, New York City.
W. D. COLT, - - - - 1420 F Street, Washington, D. C.
JOHN KIEFER, - - - 344 Lawrence, Street, Denver, Col.



THE SIEMENS REGENERATIVE GAS LAMP COMPANY.

SOLE MAKERS FOR THE UNITED STATES,

N. E. Cor. 21st. St. and Washington Av., Philadelphia, Pa.

THE "STANDARD" WASHER-SCRUBBER,

KIRKHAM, HULETT & CHANDLER'S PATENT.

Total Capacity per 24 Hours of "Standard" Washers Ordered During the Following Years.

1877	4,000,000	cubic feet.
1878	4,750,000	"
1879	24,545,000	"
1880	42,967,500	"
1881	36,462,500	"
1882	39,300,000	"
1883	57,735,000	"
1884	26,177,500	"
Total	235,937,500	cubic feet.

Total Number and Capacity per 24 Hours of "Standard" Washers Erected and in Course of Erection in the Several Countries

	Number.	Cubic Feet per Day.
Great Britain	151	157,070,000
Western Hemisphere	88	39,337,500
Australia	18	12,150,000
New Zealand	2	650,000
France	6	4,550,000
Belgium	8	5,420,000
Germany	16	8,200,000
Holland	4	4,160,000
Denmark	1	150,000
Russia	2	3,500,000
Spain	1	350,000
India	1	400,000
Total	248	235,937,500

THE CONTINUED POPULARITY

Of these Machines

Will be recognized from the following extracts from letters from representatives of some of the companies having them in use:

TOLEDO GAS LIGHT AND COKE CO., TOLEDO, OHIO, Nov. 25, 1884.

GEO. SHEPARD PAGE, Esq.:

Dear Sir—Replying to your kind favor of 21st inst., I would say that the "Standard" Washer-Scrubber is doing work that is entirely satisfactory to us. During the summer I had 12-oz. liquor; but since cool weather commenced I have been having from 18 to 23-oz. liquor, just as we would elect. There is not a trace of ammonia passing the Scrubber that a test of reddened litmus or yellow turmeric paper would indicate. The machine, in my opinion, is all that could be desired as a means for removing all the ammonia from the gas. Very respectfully,

C. R. FABEN, Jr.,
Superintendent.

"Standard" Washers Ordered During the Current Year.

	Cu. Ft. per Day
Anneberg Gas Co	200,000
Bombay Gas Co	400,000
Brussels Co	1,250,000
Chemnitz Gas Co	1,000,000
CITIZENS GAS CO., BUFFALO	750,000
Coke Works in Zabre, Ober-Schlesien	1,500,000
Cokerei der Friedenshutte, Upper Silesia	700,000
Dumfries Corporation	250,000
Dunedin Gas Co., New Zealand	400,000
King's Lynn Gas Co	300,000
Leiden, Holland	600,000
Lincoln Gas Co	400,000
Liverpool Gas Co	2,000,000
" "	3,000,000
LOUISVILLE GAS CO	1,500,000
Numea Gas Co	100,000
PITTSBURGH GAS CO	1,500,000
PORTLAND GAS CO., Oregon	562,500
SAN FRANCISCO GAS CO	4,000,000
Sheepbridge	10,000
ST. LOUIS GAS CO	2,000,000
Sydney Gas Co	2,500,000
WASHINGTON, D. C. GAS CO	2,000,000
Whitchurch Gas Co	175,000
Total	26,177,500

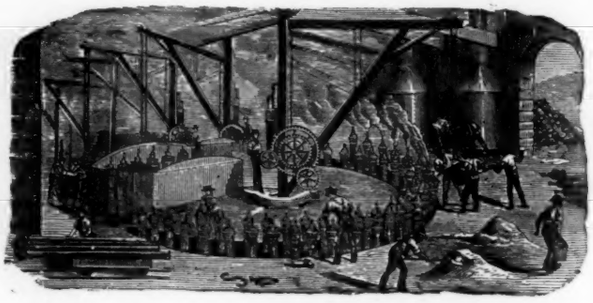
GEO. SHEPARD PAGE, No. 69 WALL STREET, NEW YORK,

SOLE AGENT FOR THE WESTERN HEMISPHERE.

A. H. M'NEAL,

BURLINGTON, N. J.

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.

JAMES S. MOORE, Pres. BENJAMIN CHEW, Treas. JAS. P. MICHELLON, Sec. WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.

NEW YORK OFFICE, 162 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.

ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc.

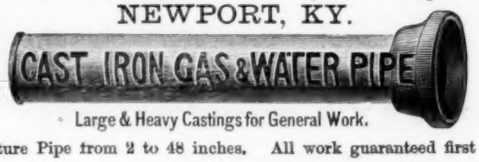
435-1

MATTHEW ADDY, President. W. L. DAVIS, Selling Agent. GEO. P. WILSHIRE, Sec. & Treas.

Cincinnati and Newport Iron and Pipe Company,

NEWPORT, KY.

Lamp Posts AND **BENCH CASTINGS** A Specialty.



Large & Heavy Castings for General Work.

Branch AND SPECIAL CASTINGS FOR GAS & WATER Co's.

Manufacture Pipe from 2 to 48 inches. All work guaranteed first quality.

Mellert Foundry and Machine Co.

Limited. Established 1848.

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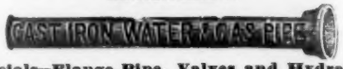


Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.

Machinery and castings for Furnaces, Rolling Mills, Grist and Saw Mills, Mining Pumps, Hoists, etc.

GENERAL OFFICE, - - - READING, PA.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th Street, Phila., Pa.

WALTER ANDERSON,

Manufacturer of all descriptions of

GAS BURNERS.

Also Metal E H. Nickel Plated Tips for Water Gas.

COR. WHITE AND ELM STS., N. Y.

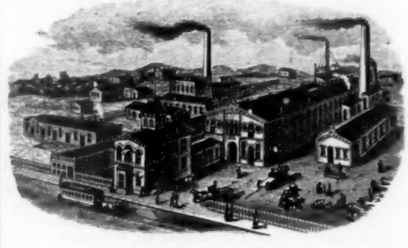
MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA, PA.

LUDLOW VALVE MFG. CO



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TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ⅜ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil.

nd for Circulars.

JOS. R. THOMAS, C.E.,

May be Consulted on all Matters Relating to Gas Works and Gas Manufacture.

ADDRESS THIS OFFICE.

KERR MURRAY MFG. CO.,

MANUFACTURERS OF

Single Lift and Telescopic

GASHOLDERS.

Built, 1884:

Altoona, Pa	Capacity,	160,000	cubic feet.
Pittsburgh, Pa	"	250,000	"
" "	"	220,000	"
Bellaire, Ohio	"	50,000	"
Youngstown, Ohio	"	60,000	"
Canton, "	"	60.000	"
Akron, "	"	80,000	"
Xenia, "	"	10,000	"
Adrian, Mich	"	65,000	"
Ypsilanti, Mich	"	25,000	"
Muskegon, "	"	70,000	"
South Bend, Ind	"	70,000	"
Anderson, "	"	20,000	"
Plainfield, "	"	10,000	"
Springfield, Illinois	"	100,000	"
Evanston, "	"	50,000	"
Freeport, "	"	35,000	"
Elgin, "	"	60,000	"
Sheboygan, Wis	"	20,000	"
Key West, Fla	"	10,000	"

Plans and estimates furnished for the erection of new and the rebuilding of old works. Address

Kerr Murray Mfg. Co.,

FORT WAYNE, IND.

JAMES R. FLOYD,

(SUCCESSOR TO HERRING & FLOYD)

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531 to 543 West 20th St., N. Y.

Practical Builders of Gas Works,

MANUFACTURERS OF

ALL KINDS OF CASTINGS
AND
APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.
WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS
(wet and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
of all sizes and description.
FLOYD'S PATENT
MALLEABLE RETORT LID.
PATENT
SELF-SEALING RETORT LIDS.
FARMER'S
PATENT BYE-PASS DIP-PIPE.
SABBATON'S PATENT
FURNACE DOOR AND FRAME.
BUTLER'S
COKE SCREENING SHOVELS.

GAS GOVERNORS,

and everything connected with well regulated Gas Works at low price, and in complete order.

SELLER'S CEMENT

for stopping leaks in Retorts.

N. B.—**STOP VALVES** from three to thirty inches—at very low prices.
Plans, Specifications, and Estimates furnished.

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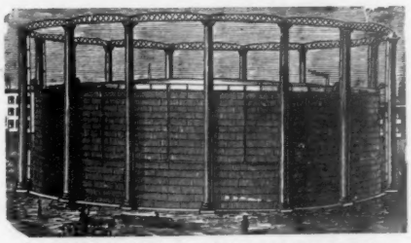

GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,
GREENPOINT, BROOKLYN, N. Y.
ENGINEER AND MANUFACTURER OF
GAS-HOLDERS.
CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,
and all other articles connected with the Manufacture Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plant for Lighting Cities, Towns, Mansions, and Manufactories.

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STACEY MFG. CO.,

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Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

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33, 35, 37 & 39 Mill Street.

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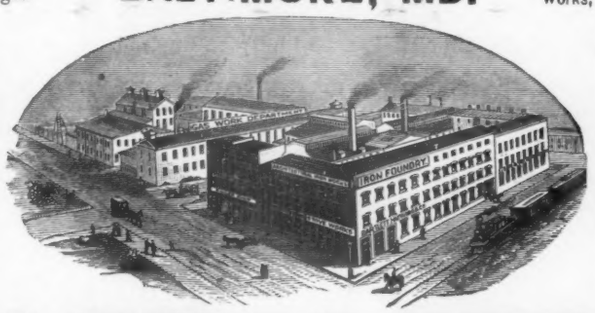
PURIFIERS. Roofs. Bench Castings.



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CONSTRUCTING ENGINEERS AND BUILDERS OF GAS WORKS.

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Laurel Iron Works.

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Fitchburgh, Mass.
New London, Conn.
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Bridgeport, Conn.
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Brattleboro, Vt.
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GAS COALS. GAS COALS. GAS COALS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

General Sales Agents.

THE YOUGHIOGHENY RIVER COAL COMPANY,

Organized August 1, 1882.

MINERS AND SHIPPERS OF THE WELL-KNOWN

Ocean Mine Youghiogheny Gas Coal.

The Coal from the Ocean Mine (recently operated by Messrs. W. L. Scott & Co., of Erie, Pa.,) is now used by all the leading Gas Companies in the United States from Maine to Texas, and is recognized as *the only reliable Youghiogheny Gas Coal.*

Messrs. W. L. Scott & Co. and W. L. Scott, Esq., still retain their interest in the new Company, and the same general policy which has characterized the management of the mine under these gentlemen will be continued by the new Company. With largely increased facilities and *unlimited supply of Coal*, any demand made upon the Colliery will meet with prompt fulfillment.

THE UNDERSIGNED CAN SUPPLY THE FOLLOWING SUPERIOR GRADES OF

GAS CANNELS:

Abram Cannel, from the Abram Colliery, Wigan, England,

Plesio-Boghead Cannel, from near the old Boghead Colliery, Scotland.

North Ince Hall Cannel, from Liverpool, England.

Breckenridge Cannel, from Kentucky. The railroad now being constructed to the Ohio river will open up this superior Cannel deposit, and enable us to deliver it at any required point. See full description of this Cannel, and Map of the Colliery, in the "American Gas Light Journal," April 16, 1883, pages 172 and 173.

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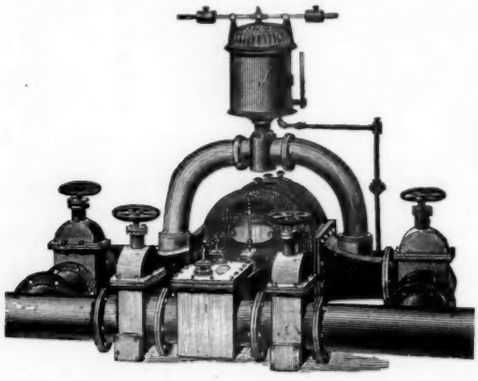

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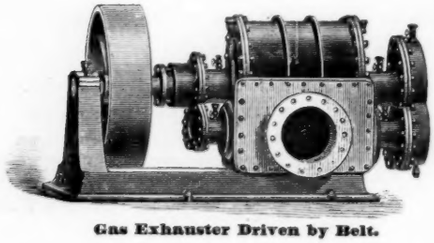
Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.



Gas Exhauster Driven by Belt.

The Wilbraham Gas Exhauster,

"BAKER SYSTEM,"

WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.

Best, Cheapest and Most Durable Exhauster known.

WILBRAHAM BROS.,

No. 2320 Frankford Avenue, Philadelphia, Pa.

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Newburgh Orrel Coal Co.,

MINERS AND SHIPPERS OF

Newburgh Orrel, Tyrconnell and Palatine Gas Coals.

ALSO SHIPPERS OF FOUNDRY COKE.

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Shipping wharves at Locust Point. References furnished when required. Special attention given to chartering vessels.

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies and Manufacturers of Fire Clay Goods Throughout the Country.

ROUSSEL & HICKS, 71 Broadway, N. Y. } *AGENTS.* { BANGS & HORTON, 16 Kilby St., Boston.

Mines in Harrison Co., West Va. Wharves, Locust Point, Balt.

Company's Office, 15 German St., Baltimore, Md.

Among the consumers of Despard Coal we name: Manhattan Gas Light Co., N. Y.; Metropolitan Gas Light Co., N. Y.; Jersey City, (N. J.) Gas Light Co.; Washington (D. C.) Gas Light Co.; Portland (Maine) Gas Light Co. Reference to them is requested.

1,000 Engines Now in Use.

30,000 H.P. NOW RUNNING!

Sales, 2,000 H.P. per Month!

SEND FOR ILLUSTRATED CIRCULAR AND REFERENCE LIST.

Westinghouse Machine Co.,

PITTSBURCH, PA.

SALES DEPARTMENT CONDUCTED BY

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Parke & Lacy, San Francisco, and Portland, Or.
Parke, Lacy & Co., Salt Lake City, Utah, and Butte, Montana.
D. A. Tompkins & Co., Charlotte, N. C.
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PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

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GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station on the Pennsylvania Railroad, and on the Youghiogheny River.

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Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

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FRANCIS H. JACKSON, PRESIDENT. EDMUND H. MCCULLOUGH, SEC. & TREAS.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

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WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The Bower Gas Lamp.

The Perfected Duplex-Regenerative Gas Burner, under the combined Patents of Anthony S. Bower, Geo. S. Grimston, and Thos. Thorp.

The First Gold Medal awarded at the Crystal Palace Exhibition in London, and two Gold Medals at the Stockport (Eng.) Exhibition of Gas Appliances. Both in 1883.

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69 Wall Street, N. Y. City.

The Management of Small Gas Works.

By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

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12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S, A.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

Maryland Meter and Manufacturing Co.,

DICKEY, TANSLEY & CO.,

Established 1866.

Nos. 22 and 24 Saratoga Street, Baltimore, Md.
No. 46 La Salle St., Chicago, Ill.

MANUFACTURERS OF

DRY GAS METERS, STATION METERS, GLAZED METERS, TEST METERS, METER PROVERS, PRESSURE AND VACUUM REGISTERS, GOVERNORS, INDICATORS, SERVICE AND METER COCKS, AND METER CONNECTIONS.

Dry Gas Meter.

With 39 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

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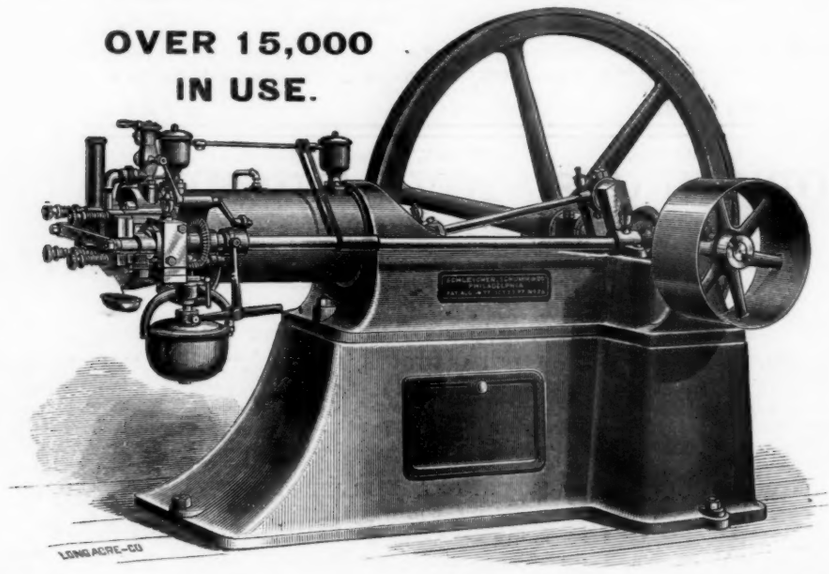

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